July 8, 1957 50 Cents

AVIATION WEEK

A McGRAW-HILL PUBLICATION

Bell X-14 Flies; Transition Next

•

Doppler Systems Enter Civil Field

Bell X-14 VTOL

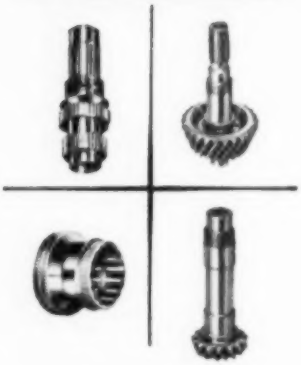
— but he's working for you

This man is hard to please. Nothing short of optimum accuracy and conformity to specifications satisfies him. We *like* it that way, and are glad we have many more people in the Inspection Departments here at Foote Bros. just like him.

Meticulous and exhaustive inspection is an important part of our production processes. It must be, because quantity production of precision gearing and actuating mechanisms for the aviation industry is our business.

It is men like these who work for you, and, in a very real sense, are the guardians of the Foote Bros. reputation for producing the finest components and assemblies of their type.

Another reason to come to Foote Bros. first, when it comes to aircraft power transmission, actuation, or gearing.



this trademark stands for the finest industrial gearing made

FOOTE BROS.

Better Power Transmission Through Better Gears

FOOTE BROS. GEAR AND MACHINE CORPORATION
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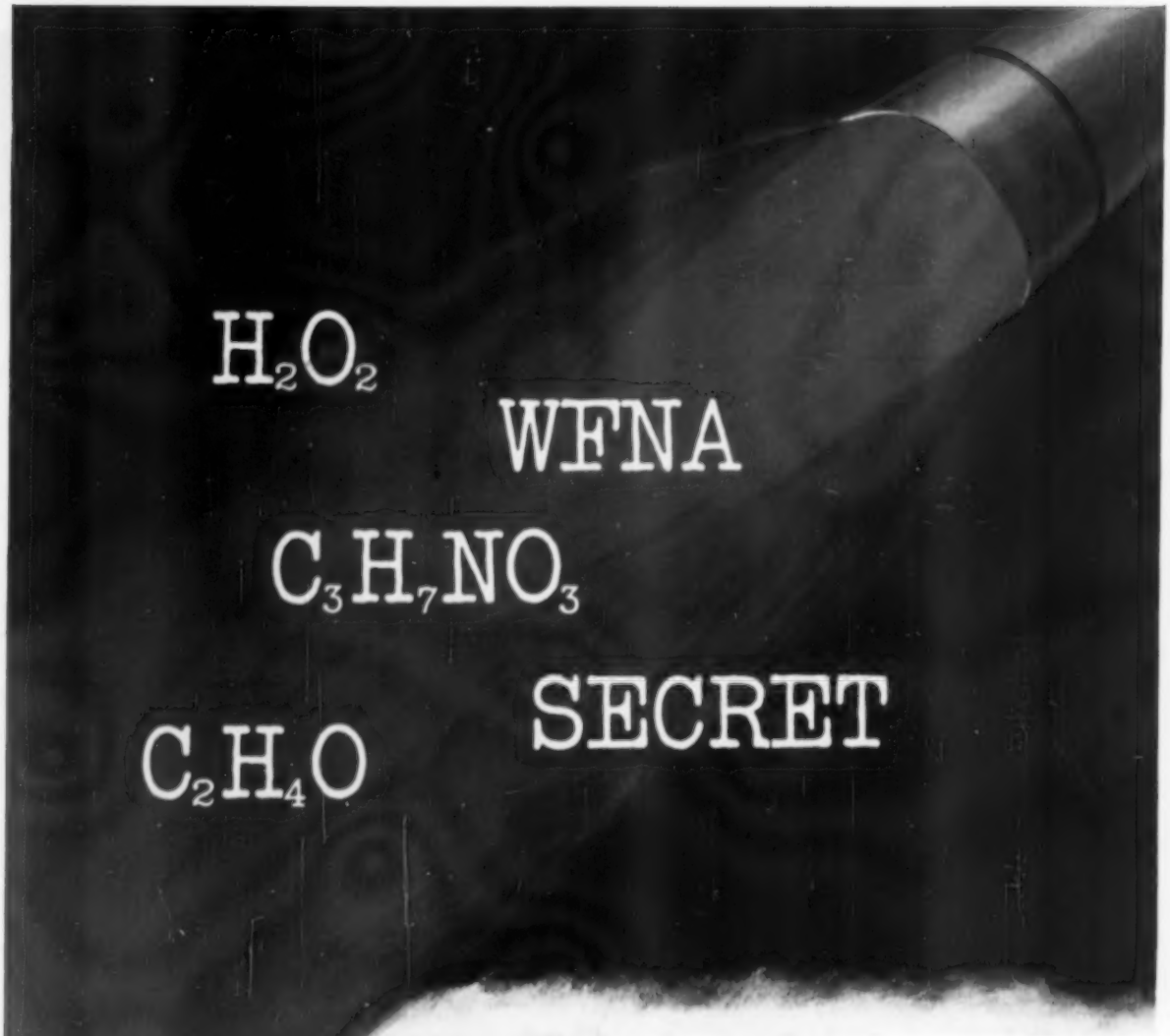

Who can handle **Fuel Cells for the Tough Ones?**

Many designers and builders faced with the problem of taming new and furious fuels to the task of powering tomorrow's planes and missiles *have discovered an ace in the hole:*

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This company has unrivaled facilities and proved capabilities in the field of fabricating cells for the new high-energy fuels.

Goodyear plants in Akron and Los Angeles have pioneered new materials and developed ingenious cells to cope with the temperature extremes, corrosive characteristics and other problems involved in the safe handling of today's monopropellants and fuel-and-oxidizer systems.

As a result, the list of planes and missiles which are utilizing this Goodyear engineering reads like "Who's Who" in powered flight, today — *and tomorrow!*

Why not let this Goodyear knowledge and engineering skill take the tough ones off your hands? Write for information. (We have some mighty interesting findings which might well advance the flight date of your project by months.) Address: Goodyear, Aviation Products Division, Akron 16, Ohio, or Los Angeles 54, California.

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To Advance America's Global
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For your requirements in aircraft passenger and crew seats, buffets and lavatories... a very specialized manufacturing capability is demanded. In all the world there is only one such Single Source, having the complete facilities... the full design staff... the age, stability and strength... the after-sale service standards... and the vision.

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A World of experience in: Passenger seats, Pilot and Crew Seats, Buffets, lavatory units and kindred aircraft interior equipment.

*SEAT: "The place where anything... is settled or established"
—Winston Dictionary

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AVIATION CALENDAR

July 12-13—British Lockheed International Acrobatic Competition, the National Air Races (third round) and the King's Cup Air Race, Coventry Civil Aerodrome, Bagington, England.

July 13-19—1957 Jaycee Air Cruise, Philadelphia, Pa.-Las Vegas, Nev. Write: G. Ralph Guthrie, Air Cruise Chairman, Junior Chamber of Commerce, 121 S. Broad St., Philadelphia, Pa.

July 28—Third Annual Jaycee Air Fair, sponsored by Portland (Oregon) and Junior Chamber of Commerce, Portland International Airport.

July 31-Aug. 4—Eleventh Annual National Convention, Air Force Assn., and Airpower Panorama, Sheraton-Park and Shoreham Hotels, Washington, D. C.

Aug. 1-2—Second Annual Exiborama and First Annual National Photo Instrumentation Symposium, Society of Photographic Instrumentation Engineers, Ambassador Hotel, Los Angeles.

Aug. 5-10—National Naval Aviation Meeting, Institute of Aeronautical Sciences, U. S. Grant Hotel, San Diego, Calif.

Aug. 10-11—Midget Airplane Races, Oshkosh, Wis.

Aug. 20-22—Bendix-Scintilla International Ignition Conference, Sidney, N. Y.

Aug. 20-23—Western Electronic Show & Convention, Cow Palace, San Francisco.

Aug. 26-28—Gas Dynamics Symposium Transport Properties in Gases at High Temperatures and Pressures, Technological Institute, Northwestern University, Evanston, Ill.

Aug. 31-Sept. 1—Midget Airplane Races, Ft. Wayne, Ind.

Sept. 1-15—Sixth International Aeronautical Conference, Royal Aeronautical Society and Institute of the Aeronautical Sciences, Folkestone and London, England.

Sept. 2-8—1957 Flying Display, Society of British Aircraft Constructors, Farnborough, England.

Sept. 3-14—11th General Assembly, Inter-

(Continued on page 6)

AVIATION WEEK • JULY 8, 1957

Vol. 67, No. 1

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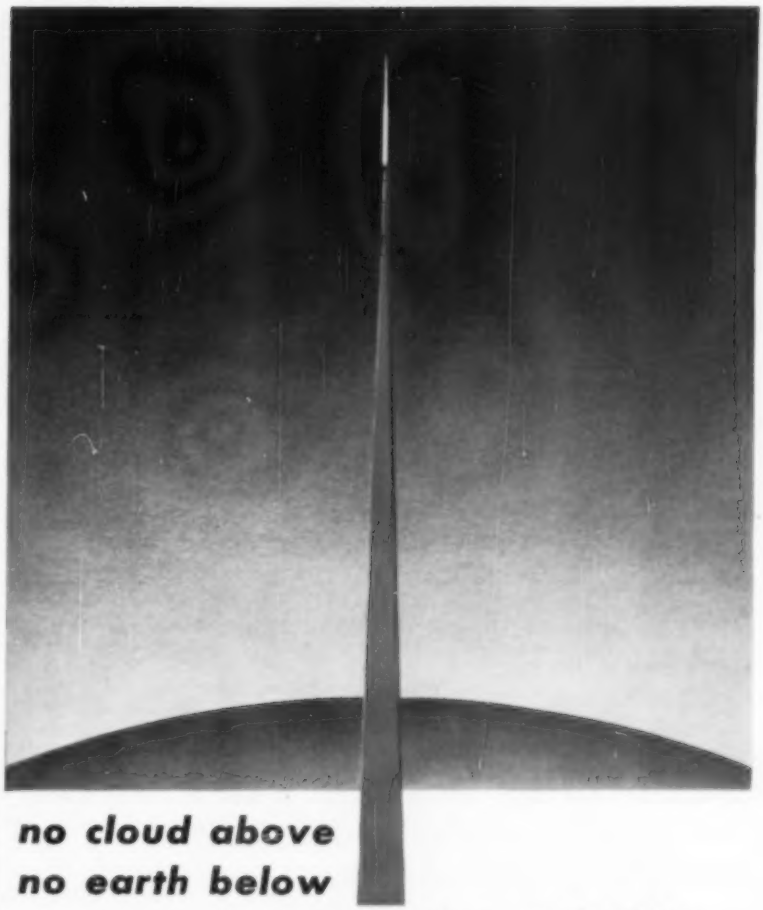

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...a universe of sky and GO!

Advanced missiles are blazing new trails in the universe of outer space . . . and precision components help determine the success of their high speed, high altitude course.

Experience, skilled personnel and modern facilities at Lavelle are focused on the precision fabrication of Missile, Engine, Airframe, and Electronic components in titanium, aluminum, stainless steel and other heat resistant, high strength alloys . . . to the most rigid specifications.

Ram jet engine cone and diffuser sections, fuel manifolds, flame holders, combustion chambers and liners are typical components made by Lavelle for major manufacturers. They rely on Lavelle's quality workmanship, dependable delivery and reasonable costs.

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New, longer, roomier Craig Helicop-Huts* pack more payload than ever!

How much room does a communications system occupy?

The answer varies, of course. That's why CRAIG now manufactures the lightweight, air-transportable Helicop-Hut in varying lengths from 76" to 134" (inside dimensions), with capacities up to 433 cubic feet.

This means more room inside, bigger payloads, with no loss of air-transportability. And with so many more sizes and capacities to choose from, these versatile, insulated "flying" shelters can now accommodate virtually any radar, navigation or communication system requirement.

Delicate electronic components and systems are now fully protected against shock, vibration, and extreme environmental conditions. Ask about current delivery schedules.

Features:

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- Aluminum skin bonded to polyurethane foam core for maximum strength, minimum weight
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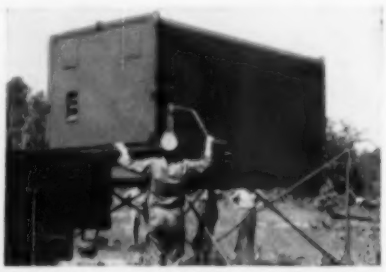

Special lifting device makes truck loading simple and quick. Helicop-Huts are also transportable by C-119 or larger cargo aircraft.

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AVIATION CALENDAR

(*Continued from page 5*)

national Union of Geodesy and Geophysics, in conjunction with International Geophysical Year, University of Toronto, Canada.

Sept. 9-13—Annual General Meeting, International Air Transport Assn., Madrid.

Sept. 9-13—Twelfth Annual Instrument-Automation Conference & Exhibit, Cleveland Auditorium, Cleveland, Ohio.

Sept. 13—Third Pacific Area National Meeting, American Society for Testing Materials, Sheraton-Palace Hotel, San Francisco, Calif.

Sept. 15—1957 Garden Party and Flying Display, Royal Aeronautical Society, Wisley Aerodrome, Weybridge, Surrey, England.

Sept. 26-27—Fifth Michigan Aeronautics Conference, jointly sponsored by University of Michigan Transportation Institute, Western Michigan University, and The Aero Club of Michigan, Alpena, Mich.

Oct. 1-5—National Aeronautics Meeting, Aircraft Production Forum & Aircraft Engineering Display, Hotel Ambassador, Los Angeles.

Oct. 2-4—Tenth Annual Meeting and Forum, National Business Aircraft Assn., Cosmopolitan Hotel, Denver, Colo.

Oct. 6-12—Eight International Astronautical Congress, Barcelona, Spain; Registrar: Agrupacion Astronautica Espanola, Arda, Generalissimo Franco, 377, Barcelona.

Oct. 7-9—13th Annual National Electronics Conference, Chicago, Ill.

Oct. 7-10—Triennial Inspection, Lewis Flight Propulsion Laboratory, Cleveland.

Oct. 7-12—Eighth Annual Congress, International Astronautical Federation, Barcelona, Spain. For details write: IAF, 35 Lowell Rd., Concord, Mass.

Oct. 9-11—National Fall Convention, Society for Experimental Stress Analysis, El Cortes Hotel, San Diego, Calif.

Oct. 21-22—Canadian Aeronautical Institute-Institute of the Aeronautical Sciences Meeting, Montreal, Canada.

Oct. 21-23—Conference on new developments in the field of power, American Society of Mechanical Engineers, Americus Hotel, Allentown, Pa.

Oct. 24-25—Fourteenth Annual Display, Aircraft Electrical Equipment, Aircraft Electrical Society, Pan Pacific Auditorium, Los Angeles, Calif.

Oct. 28-31—Second Winter Meeting, American Nuclear Society, Henry Hudson Hotel, N. Y.

Oct. 28-29—Third Annual Meeting, Association of the U. S. Army, Sheraton-Park Hotel, Washington, D. C.

Oct. 28-30—Annual East Coast Conference on Aeronautical and Navigational Electronics, Fifth Regiment Armory, Baltimore, Md.

Oct. 28-31—National Industrial Packaging & Handling Exposition, Atlantic City Convention Hall, N. J.

Nov. 5-7—Joint Military-Industry Guided Missile Reliability Symposium (limited to those with Secret security clearance), Naval Air Missile Test Center, Pt. Mugu, Calif.

Nov. 18-29—International Air Transport Assn. Technical Conference, Miami, Fla.

Pesco submerged fuel booster pump . . . removable from top of tank.

for a new breed of airliner . . . ***propjet power and 28 Pesco pumps***

Pesco Cartridge® pump for precise propeller pitch control.

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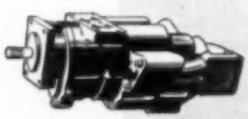

Pesco main engine fuel pump.

► The new Lockheed Electra is the first of the planes-of-tomorrow that will introduce a new era of air travel. And naturally enough, the Electras will be equipped with 28 Pesco fuel and hydraulic pumps.

As these turboprop-powered airliners cruise along at 7-miles-a-minute, Pesco pumps will be quietly performing vital jobs—transferring fuel from wing tanks to engines . . . providing a pressurized flow of fuel into the 3,750-hp engines . . . regulating the pitch and feathering action of the propellers.

Pesco is proud to have been selected as the sole source for these accessories. It is more evidence that *Pesco means progress in pumps*—for aircraft, missiles and industry.

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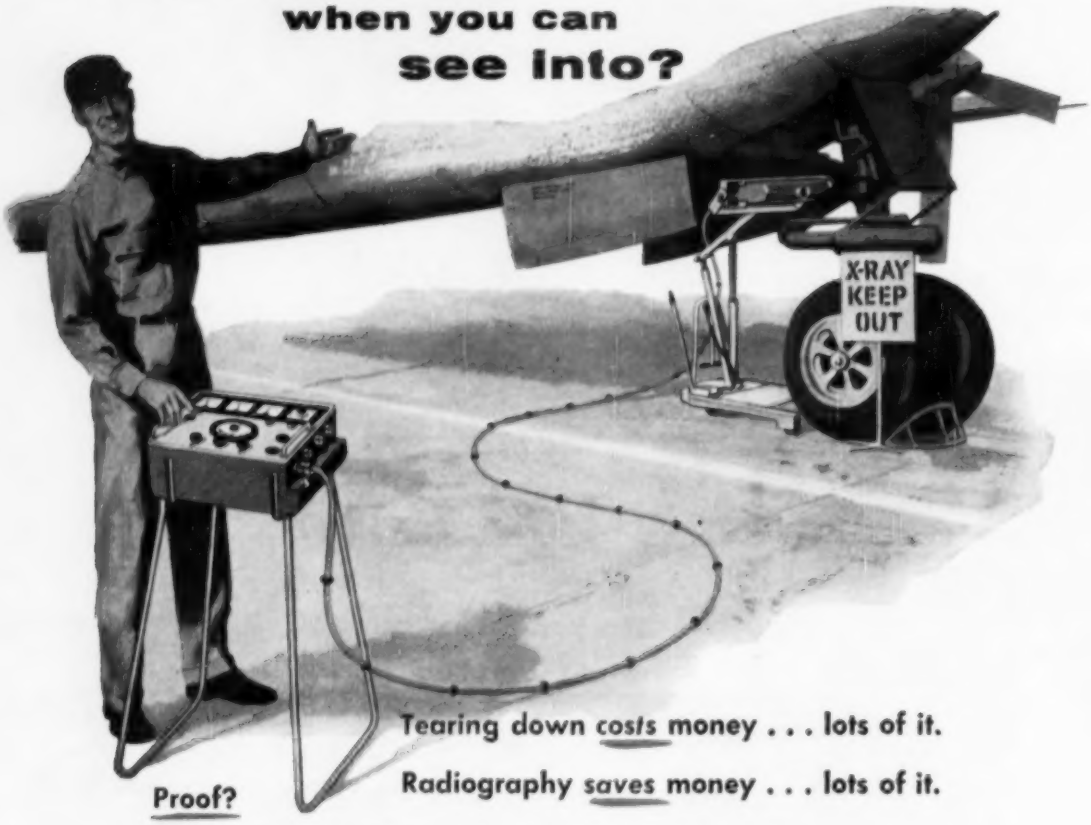
PESCO . . . engineering Pesco production BW *means progress in pumps*

why tear down when you can see into?



Tearing down costs money . . . lots of it.

Radiography saves money . . . lots of it.

Proof?

Listen to one user's experience with radiography in aircraft inspection . . . *"it is estimated that 80 manhours would be required to disassemble, visually inspect and reassemble each of the main landing gear cylinders. X-ray requires only 2 manhours per landing gear to perform a similar inspection."**

Seventy-eight hours saved in a single inspection!

Testimony like that underlines why a modern maintenance program can't afford to do without radiography.

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ANDREX lightweight portable x-ray units—130 KV, 160 KV, 200 KV, 260 KV and *Andrescope* X-ray Stress Analyzer.

PICKER x-ray units—5 to 50 KV, 150 KV (stationary and mobile), 270 KV portable, 260 KV heavy-duty, x-ray diffraction apparatus, rayproof inspection cabinets.

ACCESSORIES . . . films, tanks, darkroom sundries, illuminators, everything.

TECHNICAL OPERATIONS units for isotope radiography—sources, equipment, containers for Iridium ^{192}, Cobalt ^{60} and Thulium ^{170}.

How to be a magnetic tape recording expert

Introducing a useful new brochure on tape in instrumentation

Tape is the stuff of which memories are made — the versatile data memories for a jet propelled age of electronic miracles. If you are one who keeps up with times and techniques, it is a field well worth knowing. This new brochure gives a wide-angle view of the whole subject.

Typical pages

What kinds of applications do you think of when magnetic tape recording is mentioned? Sound recording, of course, and telemetering, if you are in that business. But what about simulating a rough road to test truck axles, controlling a milling machine to cut an aircraft wing section out of a solid billet, monitoring for a sudden occurrence that may happen only once in a year or two, recording data that can be reduced to graphs and tabulations without ever being touched by human hands? These and many more are described.

How significant is the fact that magnetic tape recording reproduces data in the same electrical form in which it was recorded? Enormously important, when you realize all the things the reproduced data can do that couldn't be done with the original signals or with the common forms of visual recording. For example the data can be slowed down to look at fast transients. It can be speeded up for wave analysis. It can be read out in any form. A tabular comparison between original signals and taped signals gives the full story. And a step-by-step pictorial demonstration of magnetic tape recording and reproduction puts the electrical-data idea into tangible, easily visualized form.

What does the data on magnetic tape look like? You can't see it, but the brochure will give you an idea of what it would be like if you could. And incidentally this may help to clarify the differences between various magnetic-tape-recording techniques.

Do you talk in tape's language? When is a tape recorder not a recorder? What is the difference between a channel and a track? What is a servo speed control? A much needed glossary gives the consensus of our views on terms.

For whom did we write this booklet . . . the expert, or the man for whom the whole subject is new? Both. It is written and illustrated so that any engineer or technically trained person can readily grasp the concepts and gain a broad understanding of the subject. If you are one of those who has already worked extensively with tape, you will find some new twists in the way the subject is explained, and perhaps ideas on new areas you hadn't explored. And incidentally, a copy of this brochure in some handy file will give you a good start in indoctrinating that new man in the department.

For your copy, write us today on your company's letterhead. Address your request to Department UU-5

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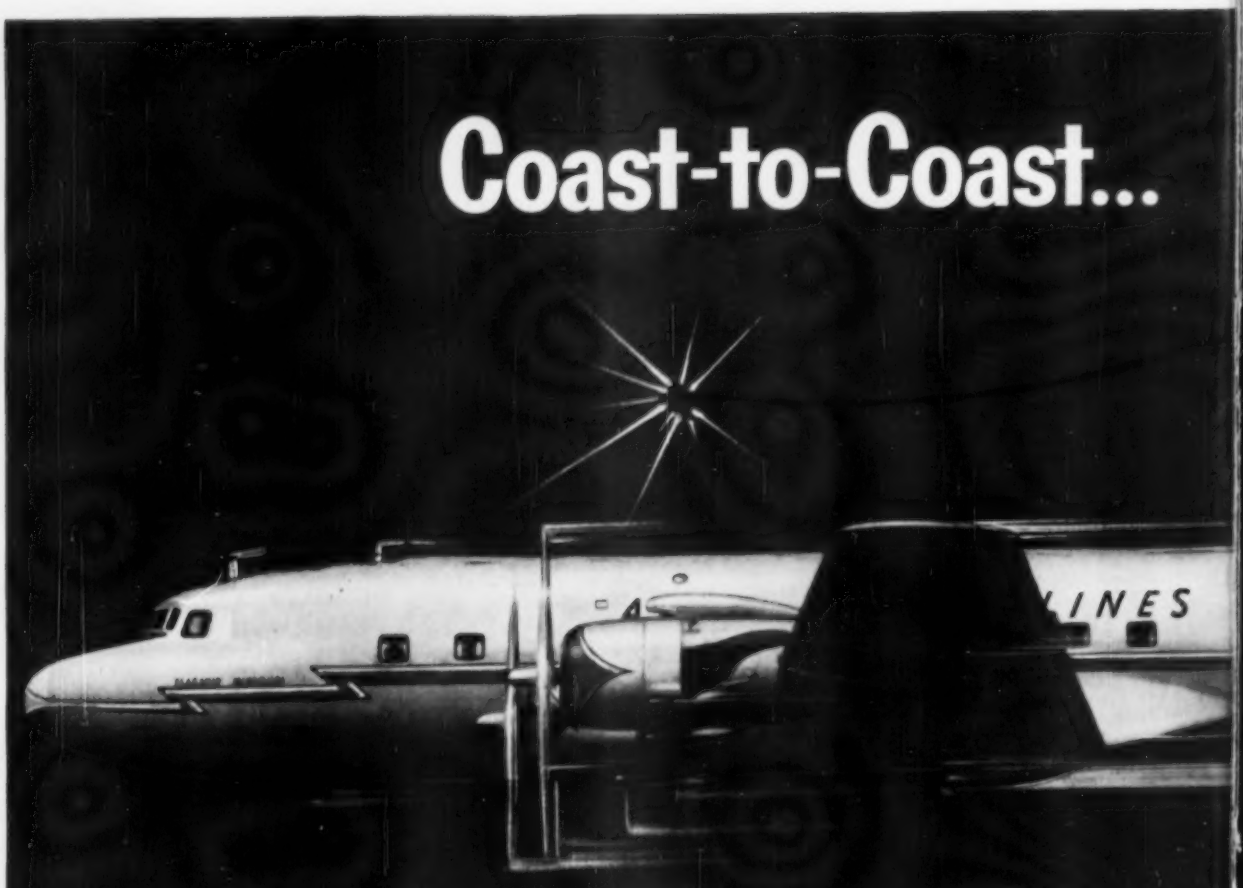

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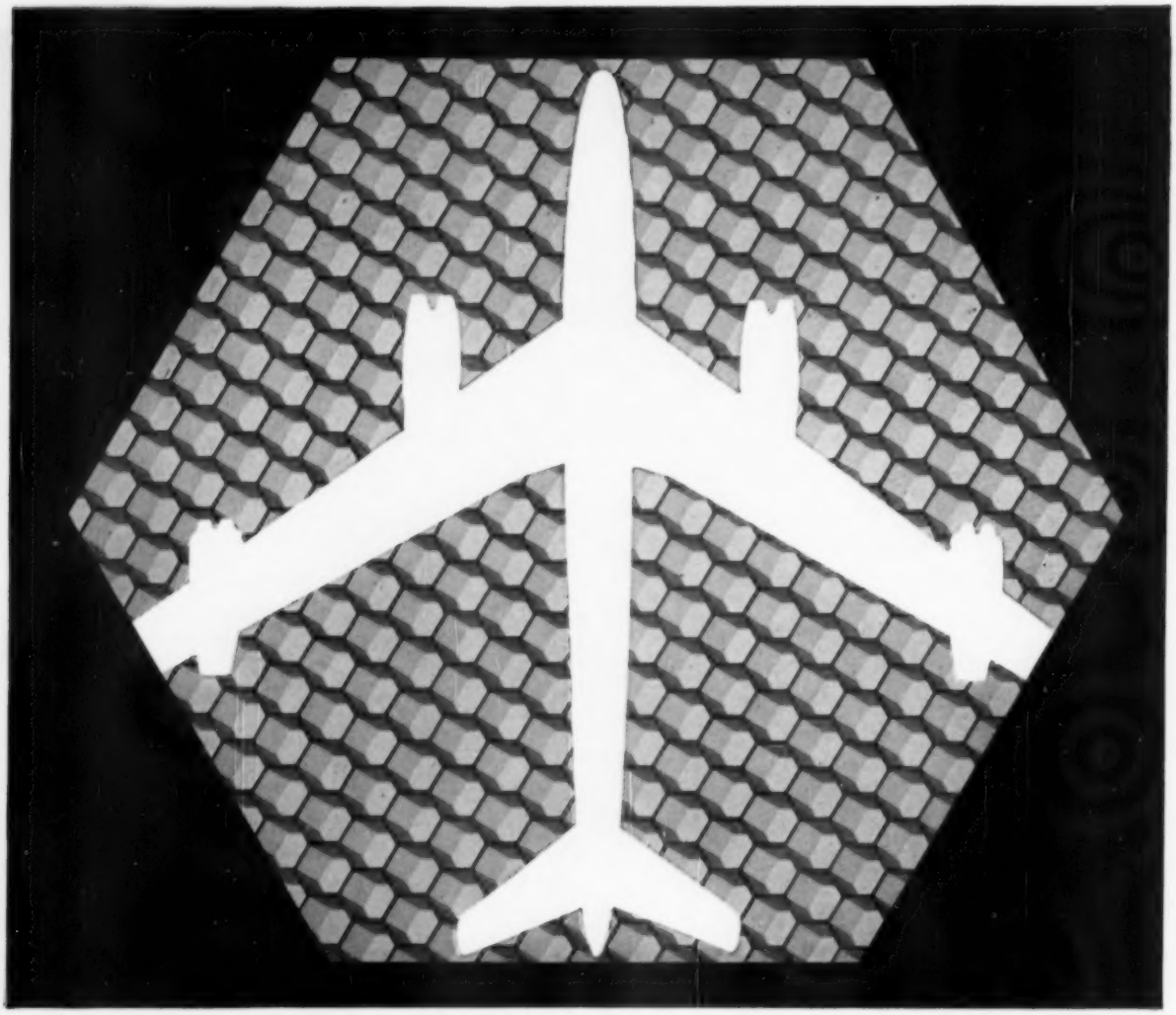

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Brunswick uses metal honeycomb core in many fabrications, including those requiring compound curvatures and extremely close tolerances. A wide variety of advanced adhesive systems is available to meet your exact requirements.

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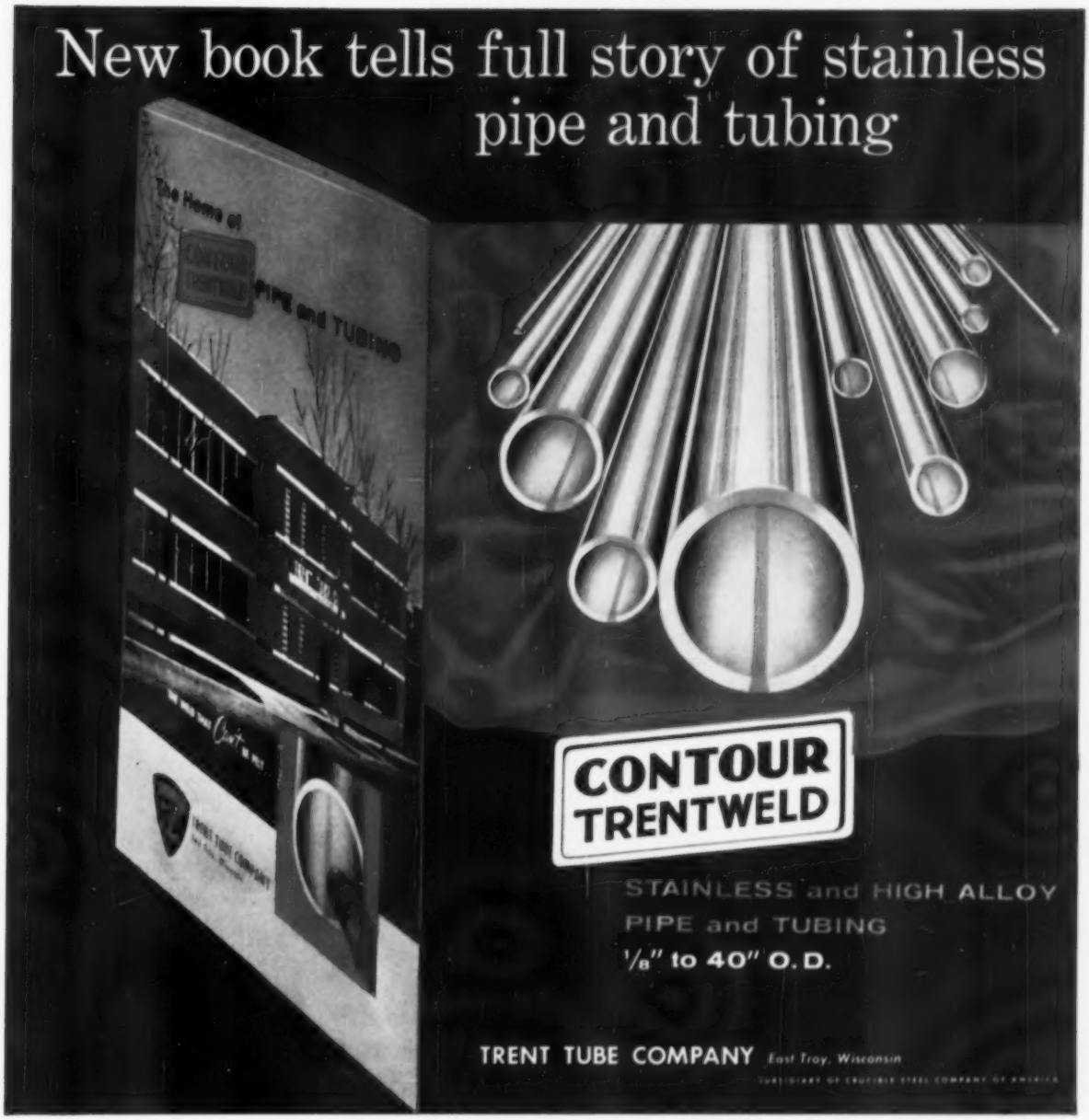
THE BRUNSWICK-BALKE-COLLENDER COMPANY 623 South Wabash Avenue, Chicago 5, Illinois

New book tells full story of stainless pipe and tubing



If you use stainless or high alloy pipe or tubing, this new illustrated handbook was written for you. It's 58 pages big – packed with informative data that you'll refer to again and again.

The table of contents is too long to list here, but it includes, for example, analysis and conversion tables, corrosion characteristics, weights, alloy properties, bending, joining and installation hints.

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A Subsidiary of Crucible Steel Company of America
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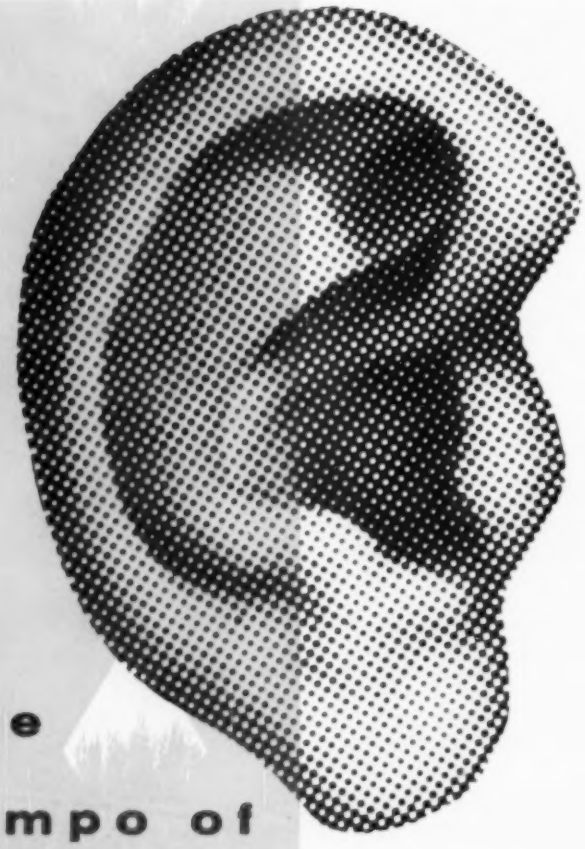

tuned to the tempo of tomorrow

Open ears lead to the open thinking that made possible today's rocket powerplants. They are alert ears—ears acutely sensitive to the unsolved problems that must be conquered in designing powerplants for the vehicles of the future.

RMI puts a premium on just such thinking. Its engineers and scientists form a talented, alert team, efficiently and effectively meeting the rocket power needs of tomorrow.

Engineers, Scientists—Perhaps you, too, can work with America's *first* rocket family. You'll find the problems challenging, the rewards great.

Power for Progress

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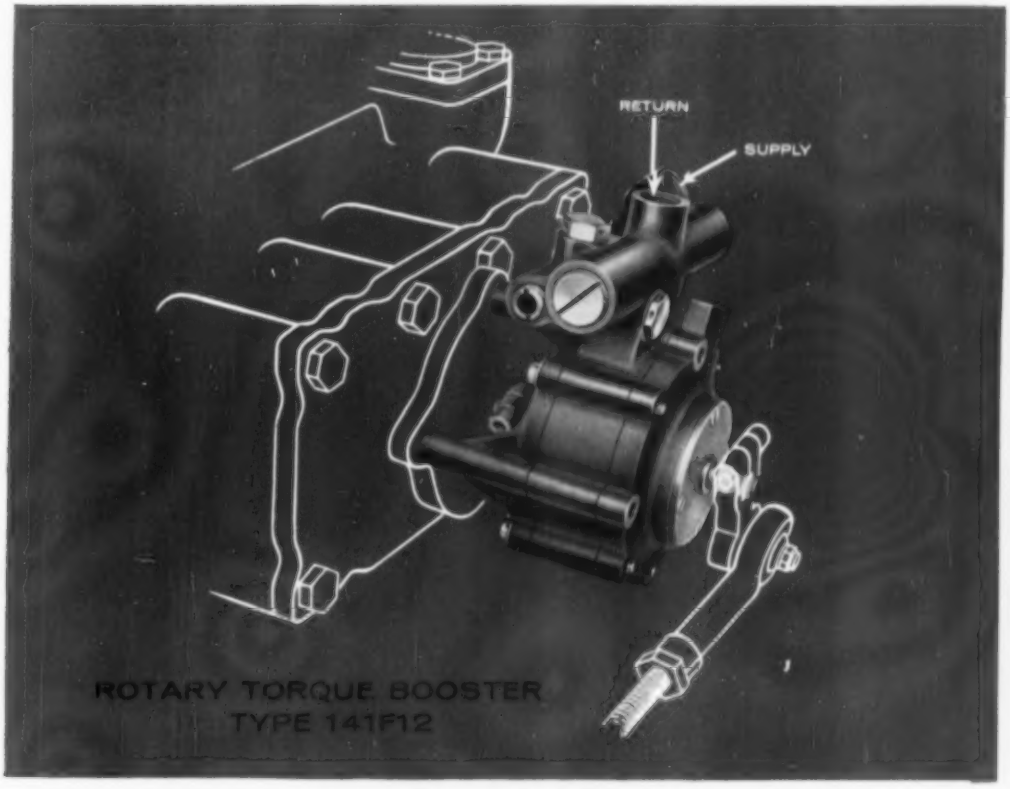
NEW FAIL-SAFE, DIRT-INSENSITIVE COMPONENT FOR CONTROL SYSTEM DESIGNERS



The Type 141F12 Rotary Torque Booster is a fail-safe hydraulic amplifier. It is commonly "sandwiched" between a turbojet engine control and the throttle lever — reduces substantially the pilot's effort to move the throttle. In a typical installation with a fuel supply of 200 psi, the torque output to the engine control is 80 inch-pounds at an input level of 10 inch-pounds. Either fuel or oil may be used as the operating medium. Pressures from 150 to 900 psig are suitable.

Unique dirt-insensitive servo valve construction, plus double failure protection against torque feedback to throttle input, accounts for the high reliability of the Booster. Even if hydraulic power should fail, a direct mechanical link permits no-boost operation of the engine control. Construction is such that input overloads of 600 inch-pounds can be handled without damage.

Manning, Maxwell & Moore will gladly provide engineering assistance in applying the Type 141F12 Rotary Torque Booster to any installation where the torque necessary for angular positioning exceeds specified requirements.

INTERESTING OPPORTUNITIES *are now open to electrical and mechanical engineers who become associated with our Aircraft Products Division. We cordially invite you to write or phone Mr. J. W. Cross, Manning, Maxwell & Moore, Inc., Shelter Rock Lane, Danbury, Connecticut.*

MAXWELL MANNING & MOORE INC. TRADE MARK

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BILL FOX, Convair's Senior Project Engineer on the F-102A, was graduated from the University of Virginia (BSME) in 1943. He has been with CONVAIR-SAN DIEGO since graduation, except for nine months with the U.S. Air Force. His success at Convair underscores the career opportunities for engineers at this "young man's company."

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"We put models through exhaustive wind tunnel tests. Mock-ups were built, checked and re-checked for construction details. A prototype based on the new 'aerodynamic recipe' was ordered. Then, in just 117 days, a new airplane – the Convair F-102A – was completed. Its wasp-waisted appearance reflected the *first application* of 'Area Rule' – made the F-102A supersonic.

"Important as this project was, it represents only *one* of the many creative assignments being solved at CONVAIR-*SAN DIEGO*—on projects like our F-102A Interceptor and Convair's 880 – world's fastest Jetliner.

"You will like this *diversity* of activity, and the Convair atmosphere, where you see and feel accomplishment. You will enjoy living in beautiful, smog-free San Diego.

"For greater career opportunity, for stimulating diversity – *for your future's sake* – write for more information about CONVAIR-*SAN DIEGO* today!" Write Mr. H. T. Brooks, Engineering Personnel, Dept. 67C.

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LINEAR?

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CLIP AND SAVE

July 8, 1957

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EDITORIAL

Transport Cuts Are Dangerous

One of the most dangerous aspects of the current administration squeeze on military airpower is the serious slash in production of gas turbine powered transports and the virtual abandonment of any further development effort in this vital area. While the overall budget squeeze has been applied by the White House and Defense Department, the decision to make transport production and development absorb the major share of this cut is a decision made by the Air Force.

It is traditional in USAF to give transports top priority on the list of things it can do without despite the evidence to the contrary provided by World War II, the Berlin blockade, Korea and Suez. There is still a quirk in top-level USAF thinking that persists in the belief that the atomic airpower combination can be effectively used without an equally effective aerial logistics system to support it.

Where Ax Will Hit

The current economy ax is scheduled to make the following cuts in USAF transport strength:

• **Douglas C-133** turboprop long-range transport with a 50,000 lb. payload capacity. Production program will be stretched out and cut substantially despite a critical need for its logistical capacity to make more efficient weapons of the entire Strategic Air Command bomber fleet, from B-47s to B-58s.

• **Douglas C-132** turboprop long-range transport with 100,000 lb. payload capacity was dropped completely after reaching the mockup stage.

Effects of these cuts and stretchouts if they stand as now programmed will mean major reduction in the future efficiency of combat forces, both USAF and Army. An effective aerial logistics system is a vital part of any modern combat effort, whether it is an all-out application of strategic airpower via manned bombers and missiles or the work of an international military fire brigade extinguishing a brushfire type of war before it can spread into a general conflagration.

Jet Transport Tanker Need

Strategic Air Command has long been dependent on aerial logistics to achieve both the range and mobility required to effectively execute its global mission. It now has a large fleet of piston-powered Boeing KC-97 tanker transports that exacts a heavy penalty in operational efficiency from the jet-powered bombers they service.

In addition, SAC employs a large fleet of Douglas C-124 piston-powered transports to carry vital spares, maintenance equipment and atomic armament along with the far ranging movements of its bomber units. SAC badly needs to replace this piston-powered tanker and transport fleet with jet aircraft of increased speed, range and payload capacity. It is true that the Boeing KC-135 will fill the jet tanker requirement, but, under the stretchout program, SAC will get them much later than it needs them.

SAC also needs a heavy load carrying capacity at the high speeds of the Douglas C-133 and C-132 giant turboprop transports to meet its other logistical requirements of the future. When SAC converts partially to guided missiles such as the airbreathing Snark and Navaho and the ballistic family of Thor, Titan, and Atlas, it will need air logistics on the scale of the C-132 to function at all.

It is utter folly to tie the logistical pace of the intercontinental missiles to the speed of trucks that took days to haul the prototype Thor and Atlas from Southern California factories where they were manufactured across the continent to USAF's Missile Test Center on the Atlantic Coast at Cape Canaveral, Fla., where they were tested.

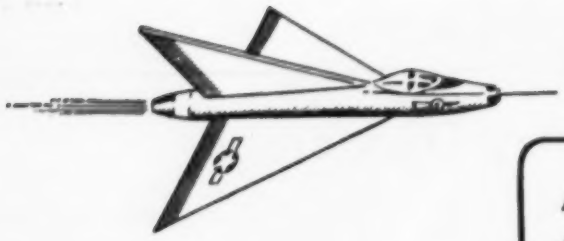
If the pentomic divisions of the Army armed with low yield atomic weapons are to have any utility as an international fire brigade, extinguishing brushfire aggressions such as the Soviets' 1950 adventure along the 38th Parallel before they expand into another Korean war or explode into global atomic war, they must have air transportability at jet speeds over intercontinental ranges. Similarly, if the Army is to discharge efficiently even its currently allocated missile responsibilities, it must have something faster than a caterpillar prime mover to haul its Redstone and replacements for Nike Hercules batteries.

Commercial Excuse

Some apologists for the transport slash will cite the civil transport reserve fleet scheduled to provide some 400 multi-engine transports on short emergency notice and fleet transports now operated by the Military Air Transport Service as evidence that ample aerial logistic capacity is being provided. They also cite the commercial jet transports being developed by Boeing, Douglas and Convair as an excuse for abandoning further military transport development.

Yet, they know full well that both the Civil Air Reserve Transport fleet, all transports now operated by MATS and all commercial jet transports under development cannot meet the large cubage, heavy payload and long-range requirements of either the current or future military problems. These types can carry unequipped personnel and light cargo, but they cannot carry ballistic missiles, hydrogen warheads, exotic fuel tankers or fully equipped modern combat troops. The squeeze now being applied to production and development of military transport aircraft will produce a serious imbalance in the future. Failure to act in this vital sphere will develop an Achilles heel of immobility in what might otherwise be airpower of overwhelming strength and superiority.

—Robert Hotz



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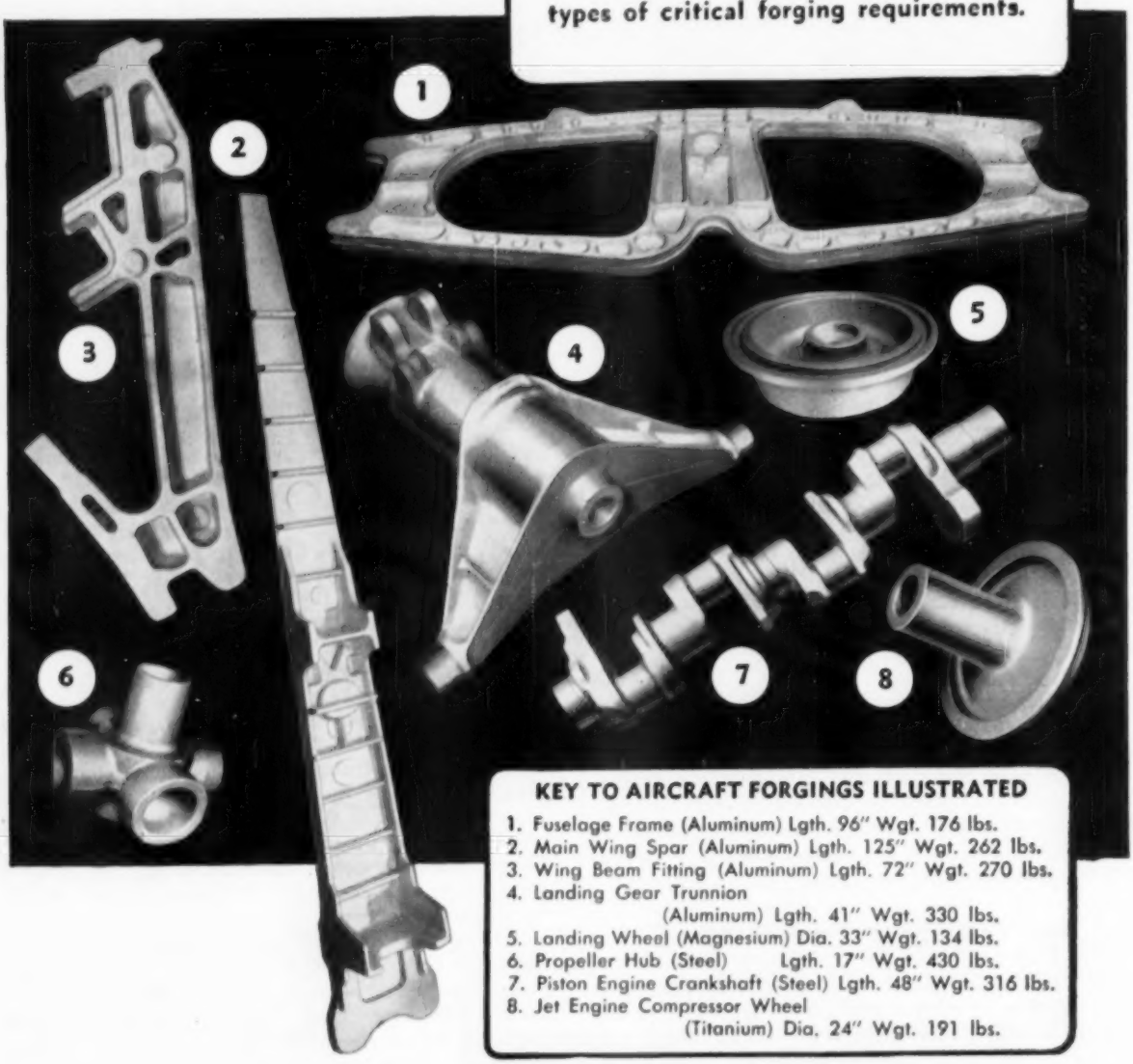

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3. Wing Beam Fitting (Aluminum) Lgth. 72" Wgt. 270 lbs.
4. Landing Gear Trunnion (Aluminum) Lgth. 41" Wgt. 330 lbs.
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E. C. Bullard, board chairman, The Bullard Co., Bridgeport, Conn. **E. P. Bullard, III** succeeds Mr. E. C. Bullard as president and general manager.

R. E. Lenhard, executive vice president, Air Reduction Sales Co., New York, N. Y. **W. A. Lunger** succeeds Mr. Lenhard as president of Ohio Chemical & Surgical Equipment Co., Madison, Wis. Both companies are divisions of Air Reduction Company, Inc., New York, N. Y.

James C. Arnold, executive vice president, Universal Electronics Co., Santa Monica, Calif.

Kenneth Stiles, vice president-plans and programs, General Dynamics Corp., New York, N. Y.

Peter S. Barno, vice president-public and industrial relations and a director, Chase Brass & Copper Co., Inc., Waterbury, Conn.

Henry Eagle, Jr., executive vice president, Omega Aircraft Corp., New Bedford, Mass.

Edward J. Healy, vice president-construction, The Kuljian Corp., Philadelphia, Pa.

George W. Stamm, vice president and general manager-sales, Crucible Steel Company of America, Pittsburgh, Pa.

Lester J. Henderson, vice president-sales, Republic Manufacturing Co., Cleveland, Ohio.

Michael E. Gluhareff, engineering manager, Sikorsky Aircraft Division, United Aircraft Corp., Stratford, Conn. Mr. Gluhareff succeeds **Igor I. Sikorsky,** retired.

Rodney A. Curtiss, counsel, Heavy Military Electronic Equipment Dept., General Electric Co., Syracuse, N. Y.

Graeme C. Bannerman, Director-Office of Procurement Policy, Office of the Assistant Secretary of Defense (Supply and Logistics), Department of Defense, Washington, D. C. Also: **Dr. H. P. Robertson,** Chairman-Defense Science Board.

Honors and Elections

Adm. John H. Cassady (USN, ret.), has been appointed president of the Flight Safety Foundation, Inc., New York, N. Y. Adm. Cassady succeeds **Rear Adm. Luis de Florez,** USNR.

Dr. Howard W. Emmons, Gordon McKay professor of mechanical engineering at Harvard University, has been appointed next year's Jerome Clarke Hunsaker Professor of Aeronautical Engineering at Massachusetts Institute of Technology.

Dr. Jerome C. Hunsaker has received the Royal Aeronautical Society's Gold Medal, the Society's highest honor, for "his contributions to aeronautical research and education, including his inspired chairmanship of the National Advisory Committee for Aeronautics. . . ."

Earle K. Brownridge, vice president-manufacturing of Orenda Engines Limited, has been awarded the McCurdy Aviation award for 1957. The award is presented annually for outstanding contribution to aviation in Canada.

INDUSTRY OBSERVER

► Russians have tested a vertical takeoff and landing turbojet aircraft similar to the Ryan X-13 (AW May 13, p. 29). Plane is reported to have excellent low speed handling characteristics, a very high rate of climb.

► **Largest single thrust chamber rocket engine for the Douglas Thor intermediate range ballistic missile is 150,000 lb. Motor developed by North American Aviation for both the Thor and Army's Jupiter IRBM has the company designation of S-3.**

► Navaho intercontinental cruise missile was lost in the waters off the USAF Missile Test Center, Patrick AFB, Fla., because of the failure of the ramjet engines to ignite after the missile had been pushed to altitude by its booster. Previous engine-booster malfunctions have caused the loss of at least two other Navahos (AW May 6, p. 23).

► **Radioplane Co.'s XQ4 supersonic target drone now under company evaluation tests at Holloman AFB, Calif., will be turned over to the Air Force sometime this fall. The high speed target is powered by a Rolls-Royce Soar turbojet. Navy's XKD4R-1 rocket powered drone has been air dropped from an aircraft pylon in tests at Point Mugu, Calif., Naval Air Missile Test Center. Powered flight should follow soon.**

► Hughes Aircraft has flown an F-102 incorporating the data link that is part of the MA-1 fire control system to be used for atomic warhead air-to-air missiles. Flights were conducted with pilot receiving all steering, navigation altitude and other flight profile information from the radar fire control scope. No words were used. All information was transmitted from ground to fire control system and translated into readable data on the scope. In its final configuration, the data link will connect ground information from the SAGE system into flight movements through an autopilot and data link. Pilot will take off and land the aircraft but otherwise will merely monitor the set for system operation.

► **Russians are flying a new intercontinental bomber of the Bison class. Four-engine bomber reportedly has two engines on each side, with the two powerplants mounted in the wing roots one above the other instead of side by side as in older version.**

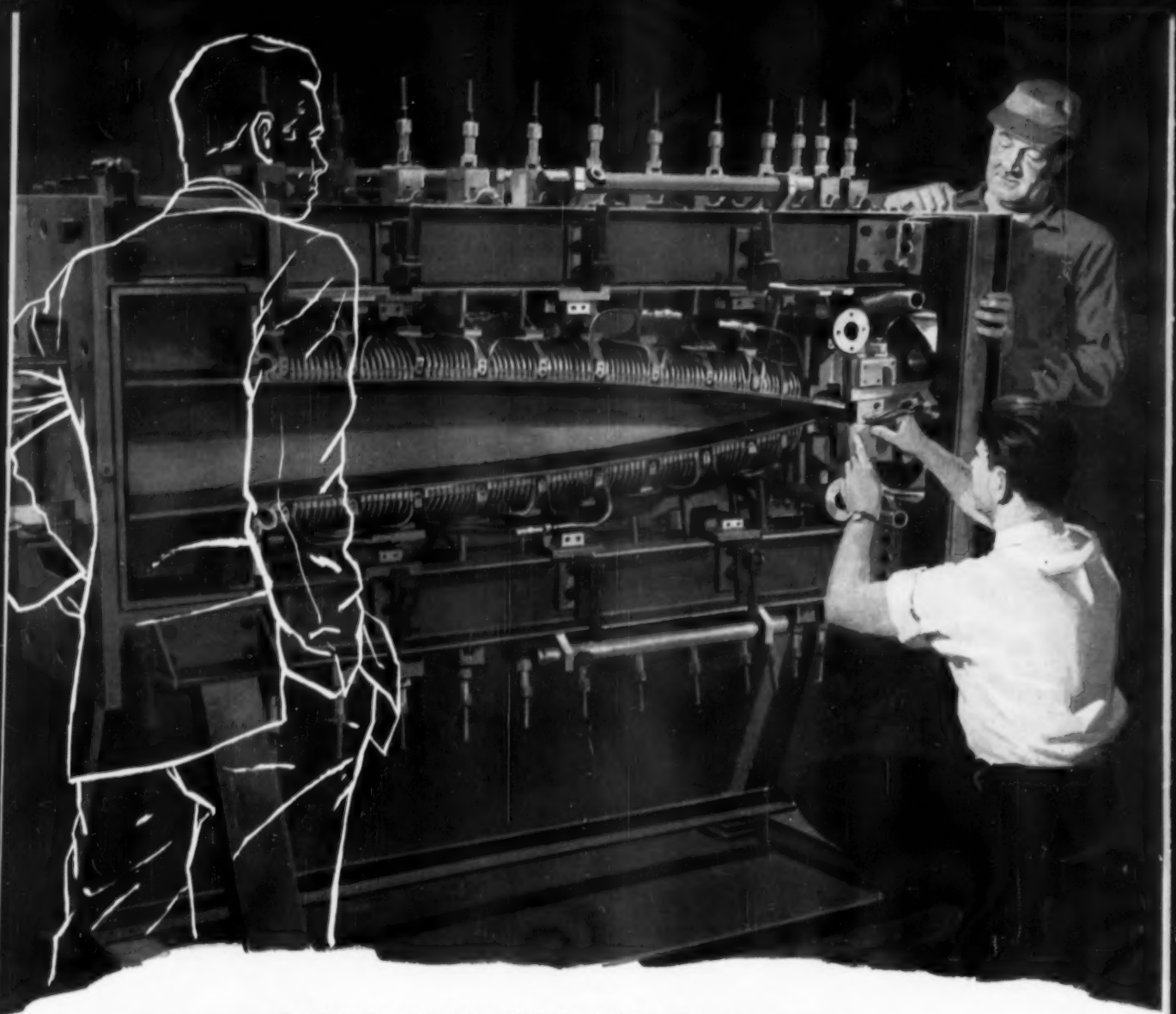
► North American A3J supersonic twin-jet attack plane will use compressed nitrogen to actuate such equipment as wing flaps, landing gear and air brakes.

► **Kaman K-17 helicopter uses compressed air jets at tips of blades of its single rotor. Air is supplied by compressor from a Bocing 502 pneumatic engine starter driven by a Blackburn Turmo turboshaft engine. The two man vehicle, which is being partially financed by Kaman, partially by the military, is expected to fly within the next few months.**

► Lycoming is testing a titanium compressor wheel in its T53 engine which saves 11¼ lb. in weight and cuts acceleration time by one second. Material costs are approximately $100 above that for a standard wheel. This is partially offset by a 20% saving in machining costs.

► **Vertol is demonstrating a modified version of its H-21 helicopter including metal rotor blades for improved flight and maintenance characteristics; vertical tail fins about one-third larger than the standard fin for improved directional stability; a "differential delta three-device" incorporated in the front rotor to reduce the pitch of blades and an automatic roll rate damper for lateral stability.**

► Nuclear aircraft research laboratory being constructed by Lockheed near Dawsonville, Ga., is scheduled to begin operation by the end of 1958. Laboratory will conduct experiments to determine radiation effects on metals and aircraft components in the search for the best materials for use in nuclear powered aircraft.



HOW THE SILICONES MAN HELPED...

CHANGE THE TUNE OF A MACH 5 WHISTLE

Ram a wind thirty-six hundred miles an hour down a wind tunnel 20 inches square. Problems in testing models of supersonic rockets and missiles in such a tunnel gave new dimensions to operational techniques.

Developed by engineers of the Jet Propulsion Laboratory at California Institute of Technology, this advanced wind tunnel presented many unique problems. In order to control the air going into the test section, movable plates were used to vary the area of the opening. The plates, moving against one another, had to be sealed. The abrasion created by this movement destroyed ordinary sealing materials. That is, until UNION CARBIDE Silicone Rubber was used. Fabricated by Reeves Rubber, Inc., of San Clemente, California, in solid strips . . . in hollow tubing that is pressurized for an extra tight fit . . . this silicone rubber performed exceptional service under almost "impossible" conditions. In fact, tests indicate that maintenance will only be required once every two or three years!

This is another example of how the UNION CARBIDE Silicones Man has helped solve an "impossible" problem. A booklet—"Look to UNION CARBIDE for Silicones" describes silicone rubber and many other silicone products. Write Dept. AW72 today. Silicones Division, Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y.

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Washington Roundup

Baker to Leave USAF

Even his intimate friends in Dayton do not know where he has found a new "challenge," but Maj. Gen. David H. Baker, Air Materiel Command's director of procurement and production, will leave the Air Force on July 31. Described as "a great challenge man," Gen. Baker is known to have accepted an industrial job with a company not involved in aviation contracting.

Possible factor in his decision is his reassignment from AMC to a new post as assistant for programming in the office of the Deputy Chief of Staff for Operations at the Pentagon. He was scheduled to take over this job next month under the new chief, Lt. Gen. William H. Tunner. There is some feeling in Pentagon and Dayton circles that Gen. Baker, who had a long career as a financial and procurement expert, was being miscast in his new position. He holds distinction as the man who called the shots correctly a year ago when he began warning industry about necessary readjustments in facilities and programming to meet the shift from manned aircraft to missile production.

Missile 'Cognizance'

Defense Department is moving forward with its plan to put missile plants under the jurisdiction of only one service. Secretary of Defense Charles E. Wilson has told the Senate Appropriations Committee:

"Steps are now being taken to place missile plants under the plant cognizance system. Even where plant cognizance has not been assigned to a single service, one service normally performs the inspection and local contract administration functions for all the services buying from the plant, thus minimizing duplication of effort and personnel."

Wright Eyes Senate

Lloyd Wright, California lawyer and chairman of the Presidential Advisory Commission on Government Security, is eyeing the Senate seat to be vacated next year by Sen. William F. Knowland. He hopes his recently-released report which calls for less government secrecy in some places, more in others, will prove to be a fitting springboard. If he makes the step, one of his primary campaign promises will be further weeding of Communists from the government.

Many Enemies, Few Friends

Meanwhile, Commission on Government Security recommendation that persons in the government or out be subject to heavy fines and imprisonment if they make public the contents of "secret" or "top secret" documents (AW July 1, p. 34) is finding many enemies, few public friends.

Although vigorously denied by Commission Chairman Lloyd Wright, main target is the press.

Major fault with the recommendation is penchant in some Pentagon quarters and other government agencies to classify even newspaper articles that have been read by thousands, a fact recognized by Wright who personally felt the bite of security last week.

Attempting to meet a challenge by Rep. John E. Moss (D.-Calif.) to produce examples of alleged security violations by the press, Wright obtained a list of 19 articles from the Attorney General's office—sources of the articles were not disclosed. Wright would have liked to release more but was blocked by the Attorney General's office and admitted: ". . . The information is apparently entombed forever, with the final rites of classified burial, in the bureaucratic graveyard of a maze of files. . . ."

Of the list Wright did release, Rep. Moss said: "The most charitable description of Mr. Wright's 'list' is that it is an interesting summary of contentions.

"It certainly is not evidence of wrongdoing on the part of the press."

In his investigation, which led to charges that in a few instances the press had "purloined" secret documents, Wright relied entirely upon the Justice Department, failed even to consult officials of the three services. Reason for this is that Wright's staff is largely staffed by former Federal Bureau of Investigation agents.

Gen. Guy S. Meloy, Jr., Army chief of information, told the Moss subcommittee last week that he had never heard of a case in which a reporter had "stolen or purloined" secret military information. USAF and Navy officials are expected to say the same when they appear before the subcommittee this week.

More Competition

Congressional pressure on Department of Defense to narrow the area of negotiated contracts in favor of competitive bidding is increasing. Senate Small Business Committee's Chairman Sen. John Sparkman (D.-Ala.) made a concrete challenge with publication of a list of 567 items being procured by the military services by negotiation which he said could be procured through competitive bidding. Among the items were engine flywheel assemblies, resistors, and transformers.

Sparkman said items are being contracted by negotiation because the Defense Department has failed to establish specifications. This, he said, "is a foolproof system for killing off unwanted competitive bids."

During the first nine months of 1956, 93% of the number of contracts and 92% of the dollar volume of contracts let by the military services were negotiated.

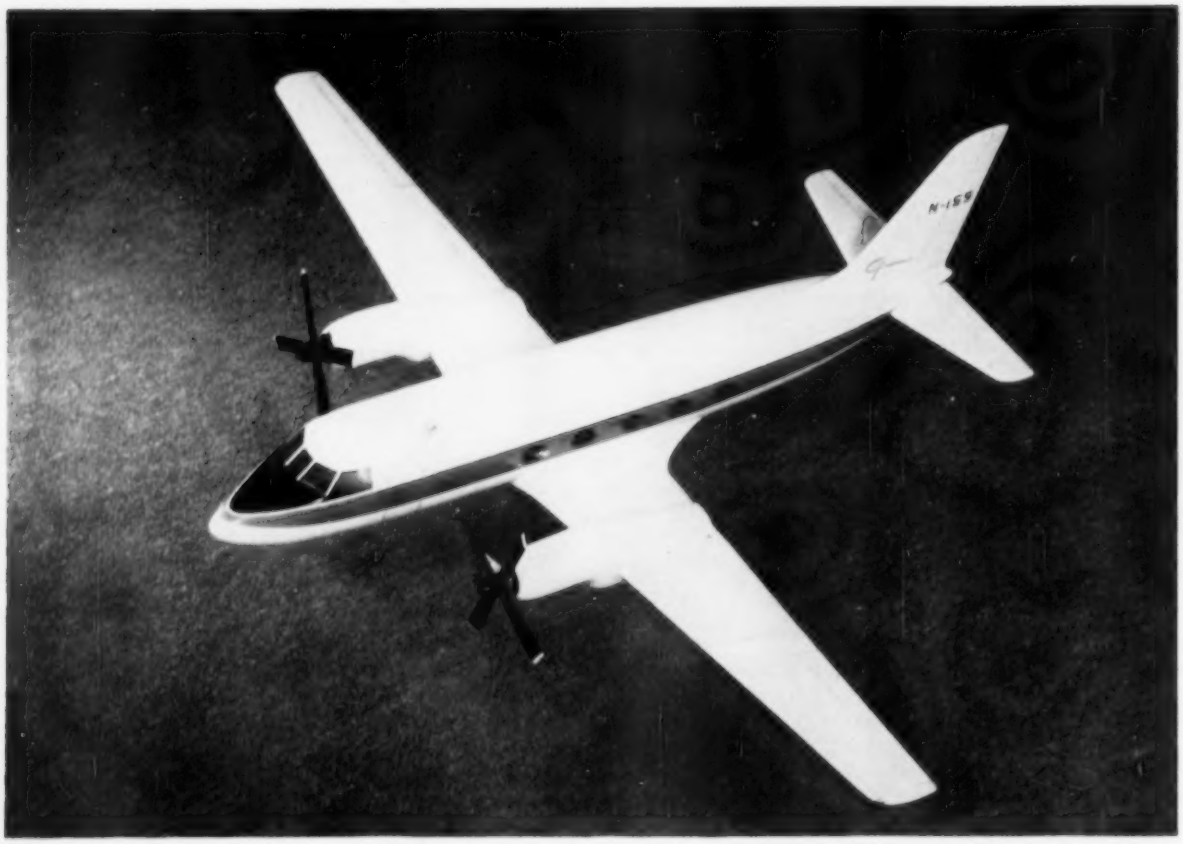
Civil Air Legislation

Three civil aviation measures have moved forward in Congress.

They provide:

- **Airways Modernization Board.** Legislation providing for this three-member Board to direct the development of an airways navigation system was passed by the Senate.
- **Permanent certification for U. S.-Alaska carriers.** The measure was approved by House Commerce Committee despite opposition of the Civil Aeronautics Board and Secretary of Commerce Sinclair Weeks. Previously, it had been approved by Senate Commerce Committee. The carriers affected are Alaska Airlines, Pacific Northern Airlines, Northwest Airlines. House Committee specified that the permanent certificates should not be transmitted to the White House for presidential approval.
- **Continuation by members of Civil Aeronautics Board** after the expiration of their term until a successor can be appointed. This was approved by the Senate Commerce Committee as a stopgap to minimize vacancies on the Board. The measure places a limitation of 120 days on the service after expiration of a term.

—Washington staff



FIELD SURVEYS set pattern for Grumman 159 basic layout; ready availability of proven Dart turboprops dictated powerplant choice.

Grumman Transport to Roll Out in 1958

Factory will deliver turboprop 12-passenger airplane bare to distributors for fitting out and sales effort.

By Erwin J. Bulban

New York—Competition to develop advanced business transports to replace the obsolete DC-3 Lodestar types gained strong impetus when Grumman Aircraft Engineering Corp. revealed today that it will roll out a 12-passenger turboprop-powered airplane from its Bethpage, L. I., plant in May, 1958.

Grumman's Design 159 is the latest entry in the new class of pressurized piston, turboprop and jet-powered businessliners being developed by Cessna, Lockheed, North American, Fairchild, McDonnell and a number of other U.S. manufacturers (AW July 1, p. 82). It is also another indication of the swing toward the rapidly growing business plane field by manufacturers who formerly were primarily engaged in military aircraft production.

Unlike most of the other projects, which are also designed to meet USAF-Navy requirements for crew trainer and high speed light transports, Design 159 is being developed primarily as a civil airplane and will be certificated under Civil Air Regulations Part 04b transport category. It will also be capable of carrying 20 passengers using high-density seating.

In addition to marking Grumman's re-entry into the business plane field, which it left at the outbreak of the Korean war, the new venture will also be of prime importance to major executive aircraft service center operators.

Break With Precedent

To market its new airplane, Grumman will break a precedent whereby it previously sold commercial aircraft through the factory. It will appoint distributors to handle Design 159. Representatives will be sought first covering the U.S. market; later, distributors will be selected in Canada, South America, Europe and the Australian area, as conditions warrant.

Grumman plans to deliver to distributors a bare-hull airplane, leaving them to furnish the interiors, radio and navigation equipment installations and accessories. Not only will this free the plant of need for setting up costly and extensive upholstery, woodworking and installation shops, but it will provide the authorized factory distributor with considerable business in furnishing these services.

Indications are that the number of distributors will be small. Obviously only those with extensive experience in this type of work and with facilities capable of handling large multi-engine airplanes will be considered. Apparently Grumman will first evaluate key centers during development of its distributorship program. Current thinking is along the lines of, "Don't call us, we'll call you." A company spokesman stated that presently the company does not want to be swamped by would-be distributors seeking franchises.

Grumman has built a full-scale mockup of its new Design 159, which is still to get finishing touches, including installation of changes as the project develops.

It has a large group of engineers engaged on the design, though no as-

semblies have been fabricated. The Navy prime contractor has a reputation for building prototypes in short time from start of design and also for production soon after first flight of prototype. Initially it plans to build two prototypes to accelerate testing and certification programs, using its Florida facility for flight testing should weather in the New York area hold up operations.

Company has been discussing Design 159 with top-flight U.S. corporations since early this year and says that response to the project has been enthusiastic. It has also developed a sales brochure outlining its project.

Basically a low-wing monoplane with retractable tricycle landing gear, circular fuselage and high-aspect ratio wing, Design 159 will be powered by two Rolls-Royce Dart RDa. 7/2 engines having a takeoff rating of 2,105 eshp. each. Propellers will be four-blade 11.5-ft.-diameter Rotols.

Specification

Design gross weight will be 31,000 lb., empty weight 12,000 lb. Carrying 12 passengers the airplane will cruise at 370 mph. at 25,000 ft., at which altitude its pressurization system will maintain equivalent of 5,500 ft.

Range with 1,480 gal. of fuel, all outboard of the fuselage, will be 2,200 mi. maximum, plus customary hold and alternate airport requirements. This includes 230-mi. diversion and three-quarter hour hold at 20,000 ft.

Grumman is stressing the airplane's airfield requirement capability. At 31,000 lb. gross weight, the airplane is designed for a CAA field length of about 4,000 ft.; at 26,000 lb. it will get off from 3,000 ft. Takeoff run from a 5,000-ft. altitude airport will take just over 5,000 ft. at full gross. Two-engine rate of climb at rated power is given as about 2,300 fpm. at sea level; single-engine rate of climb as about 700 fpm. at this altitude.

Company notes that it is planning design stretch into the 159 to take care of future growth of the Rolls-Royce Dart powerplant, to increase the service life of the airframe and make it a sound investment. Price of approximately $1 million is mentioned by industry observers for the 159, but Grumman declines to discuss a figure, saying that at this stage it is too early to come up with a firm cost and that plans to distribute the airplane on a bare-hull basis also cloud the issue at present.

Wingspan will be 78 ft., just a little shorter than the Convair 440's 79 ft. 2 in. Design 159 will be 64 ft. long and its overall height will be 22 ft. 1.5 in. Cabin height will be 73 in. and length 31 ft. 6 in.

Elliptical windows will measure 17.5 in. x 24 in.

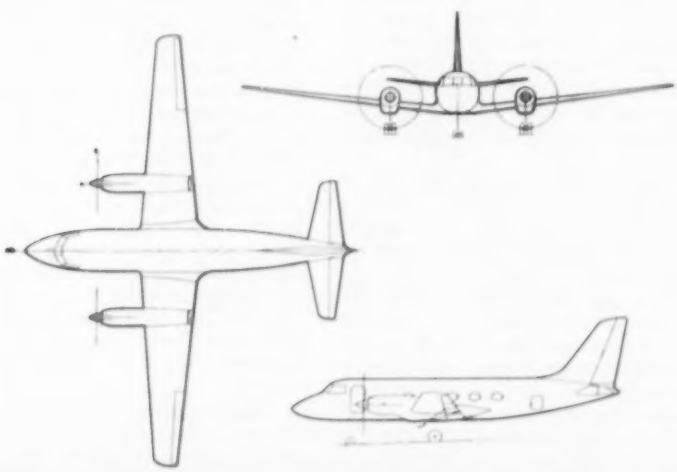
Airplane is designed to be self-sufficient, lessening dependence on airport facilities, particularly at off-airline points. A self-contained stairway on the left side just behind the cockpit will be operated by the pilot. Top step will angle out from the fuselage. The steps leading up are parallel to the fuselage, keeping passenger traffic clear of the propellers.

An auxiliary power unit will provide on-the-ground operation of cabin air conditioning, radio, lights and other equipment independent of the engines.

Army Orders H-40

Washington—U. S. Army has ordered nine production models of the Bell H-40 helicopter, now designated the HU-1. The aircraft is still undergoing tests which are being conducted with nine experimental and prototype aircraft built under earlier contracts.

The five-passenger helicopter, powered by a Lycoming T53 turbine engine, will be called the "Iroquois" under a new Army designation system under which all aircraft will be given Indian names.



HIGH-ASPECT ratio wings, large flaps are to keep takeoff roll short and aid range.

Low Drag Control Unit Tested by ARDC

Baltimore—Martin B-57 bomber with one slotted and ducted wing for the study of cost and weight penalties of a low drag boundary layer control system will be flown by Air Research and Development Command and Northrop Aircraft Inc. Results are expected to permit design of a low drag boundary layer control aircraft.

This application, which could greatly extend the range of combat aircraft if it can be applied successfully, has been under intensive investigation by Northrop and ARDC's Wright Air Development Center for seven years.

The concept utilizes slots along the wings, fuselage and tail surfaces. Air is sucked through the slots and exhausted out the rear, adding to the jet engine's thrust.

Theoretical analyses, wind tunnel tests and flight tests on a modified F-94 have revealed that friction drag on the wing surface is reduced to one-seventh by sucking air through slots.

ARDC also is studying high lift boundary layer control to aid takeoffs and landings. This system either sucks or blows air at the leading edge of the wing or just in front of the flaps.

USAF Awards Snark, Nose Cone Contracts

Washington—USAF last week reported the award of three contracts to advance the program for introduction of long-range missiles:

- **Northrop Aircraft Inc.**, Hawthorne, Calif., a $73 million production order for Snark SM-62 intercontinental guided missiles for the Strategic Air Command.
- **General Electric Co.**, Philadelphia, $158 million for development work on a nose cone for the Thor intermediate range ballistic missile and the Atlas intercontinental ballistic missile.
- **Avco Manufacturing Co.**, Lawrence, Mass., $111 million for development of a nose cone for the Titan intercontinental ballistic missile.

Announcement of the order for Snark missiles included first official disclosure that the weapon has been assigned to operational units as reported by AVIATION WEEK on Jan. 21 (p. 31). Prototype versions have been fired from the Air Force Missile Test Center at Patrick AFB, Fla.

Tax Decision Hits West Coast Industry

By Claude Witze

Washington—Department of Defense has withdrawn its recognition of tangible personal property taxes as an allowable cost, leaving major aircraft manufacturers in Los Angeles County faced with a critical financial situation.

Cutoff of allowability at this time by the Defense Department is viewed in some West Coast circles as creating an industry situation more serious than any of the procurement policy changes handed down by the Pentagon in recent weeks (AW July 1, p. 26). The industry is not critical of the department's decision, which has a firm legal basis, but is seriously concerned by the threat that a staggering amount of capital will be impounded until an extended court battle can be completed.

Despite a Superior Court decision which ruled that West Coast levies on government-owned inventory, work in process and productive equipment are illegal, Los Angeles County has appealed its case to the California Supreme Court.

At the same time, it has drastically changed its methods of assessment for 1957 so that the taxes for this year would net more than the levies for the four previous years combined.

Defense Department estimates it has paid about $22 million in property taxes to West Coast local governments in the past four years. This averages $5.5 million a year and under the new assessment policies the rate would jump about four times in calendar 1957, to $22 million each year.

Why Defense Decision

Only the airframe and missile manufacturers are involved, having been singled out by the county governments, probably because they have a large percentage of federally-owned property in their plants.

Meanwhile, Defense Department has concluded it cannot pay contractors to reimburse them for a tax held illegal by a recognized court. The government has held that the taxes were illegal from the time they were first levied in 1953 but continued to reimburse contractors pending settlement of a test case.

Test suits filed in 1954 involved General Dynamics Corp. and Aerojet-General Corp. vs the County of Los Angeles. On June 10, the Superior Court ruled the taxes illegal and said the contractors had no taxable interest in the property already paid for by the federal government.

Not only are the California counties of Los Angeles, San Diego and Alameda continuing to assess the tax, but they now have abolished the granting of credit for partial payments and solvent credits and insist on assessment of full inventory valuation.

The result is that the levy on one major manufacturer for calendar 1957 will be about $6.2 million, more than the tax for the previous four years combined. Another firm, which paid about $900,000 in 1956, will have a tax bill of more than $2 million this year.

A major risk is involved if any of the companies refuse to pay the taxes on government property in their possession.

If the payment is not made, pending final court settlement, Los Angeles County is free to seize company assets, including bank accounts, and close down the business.

If, on the other hand, the companies put up their own capital in order to stay in business, they will be shouldering a serious financial burden, placing themselves in a poor competitive position relative to manufacturers in other parts of the country. On top of recent warnings that the industry faces serious cutbacks and pressure to slash unit costs, the West Coast manufacturers now fear permanent damage from the local tax situation.

Tax Money Impounded

As long as the controversy continues, the tax money theoretically is impounded by the county government to keep it available for repayment if the final decision is in favor of the federal government and the contractors.

In the case of Los Angeles County, however, the impounded 1954-1955 taxes were released and partially spent in 1956. After the lower court decision, the impound was restored, and the county now is setting aside tax money at the reported rate of $3 million a year to rebuild its fund and make it possible to repay the various contractors.

Actually, funds impounded for the years prior to calendar 1957 belong to the defense department in those cases where the government reimbursed the contractor.

Now that the Defense Department has cut off the allowability, only contractor funds will be involved.

Defense contracting officers have been told to make it clear to manufacturers that the government will reimburse them for the taxes if the California Supreme Court reverses the early decision and declares the levy is legal.

Also, the Department is directing manufacturers to file for refunds of 1954-1955-1956 taxes, which legally belong to the federal government.

Another Possibility

Another interesting possibility, admittedly remote, is that the Defense Department could now demand repayment by the contractors of taxes allowed as a contract cost in 1954, 1955 and 1956.

Having decided that the lower court ruling must dictate its policy from 1957 on, it could argue that the industry collected for an illegal tax in the previous three years and must refund the money at once.

The Department, however, has sided with the industry from the beginning and still is providing guidance for the legal battle.

It is not expected to add further complications.

IAM Drafts Plan For '58 Negotiations

Denver—International Assn. of Machinists will place major emphasis on four specific demands in 1958 contract negotiations with the nation's aircraft industry:

- **Company-wide union shop** agreements as a first step towards uniform industry-wide conditions.
- **Special contract provisions** for skilled workers and various salaried technicians, including a percentage wage increase rather than a flat cents-per hour raise.
- **General revision** of the entire wage structure.
- **Extension of apprentice training** throughout the aircraft and guided missile industries through both contract provisions and "efforts to persuade the Department of Defense to require approved apprentice training programs of all government contractors."

The four principles of attack were laid down here during the sixth IAM Aircraft and Guided Missiles Conference.

The delegates to the convention postponed until January any decision on the amount of the wage increase to be sought because of the "uncertainties" of "the cost of living, the extent and speed of disarmament and the resultant conditions of the aircraft industry."

The union says it "expects" industry to put forth a plan for a shorter work week in order to spread the available work but with no increases in salaries for employes.

LOCKHEED F-104 Starfighters on production flight test line at Palmdale, Calif. Defense cutbacks mean stretchout for fighter. First four aircraft are production F-104As with dorsal spine, inlet wedges. Last plane is prototype without them.

Lockheed, Atune to USAF Warning, Plans Expansion Into Avionics

By Alpheus W. Jessup

New York—Lockheed Aircraft Corp. will expand rapidly into the military and commercial electronics business.

Necessary organization would be acquired by purchase if a suitable opportunity is offered, Lockheed Chairman Robert E. Gross told the N.Y. Society of Security Analysts last week. "But we are not going to wait," he said. "We will build our own competence."

Direct expansion into avionics has been under consideration for some time, but it was obvious from Gross's remarks that warnings from the Pentagon about future fluctuations in aviation industry business (AW July 1, p. 21, 26) are prodding Lockheed.

Present Level

Emphasizing that for several years authorizations for defense would not decrease but stay at the present $38-billion level, Gross said, "there is no question that in the future there will be fewer weapon systems procured by the government, fewer prime contractors needed to carry on the defense job, and far greater competition."

Strengthening Lockheed's competitive position in weapon systems management was the crux of his reason for expansion into avionics:

"To handle these big defense systems involving billions not millions of dollars and covering a multitude of sciences, we must broaden and deepen our competence into fields related to ours. The one I think of as most logical and natural is electronics.

"We and other aircraft companies already have had a great deal of experience in buying, evaluating, installing, testing and making workable all kinds of electronic devices for airplanes and missiles. . . . I feel the air industry should have a stonger position in both military and commercial electronics . . .

"Increased strength in this field will supplement our skill and experience in airframe manufacture and bolster our all-round capability for weapon system management."

Nucleus for a Lockheed electronics division could be drawn out of the Missile Systems Division. Included on its staff, for example, is Louis N. Ridenour, former chief scientist for the Air Force and editor of the MIT Radiation Laboratory series.

Cutback Effect

Effects of the administration's effort to keep defense spending within the $38 billion level, Gross said had already been felt by Lockheed with:

- **Cutback** in a Navy trainer order, presumably the T2V.
- **Stretchout** of F-104 production.
- **Cancellation** of the W2V radar aircraft "for the time being."

No mention has been made of any cutback or stretchout of the C-130 Hercules transport, Gross noted. Lockheed has a backlog of $250 million for this cargo transport.

Whether there will be additional rescheduling of aircraft production won't be known for several weeks, Gross stated.

He said he had recommended to USAF that nothing in the defense program be canceled but that everything be slowed up just a little bit to bring current spending within the limits established by the administration.

Gross attempted to instill some caution into popular conception of the

pace of missile developments. A shift to missiles is coming, but it is gradual, he said, and "it will be 1961 or even later before missile procurement passes expenditures for manned aircraft."

Noting that missiles "may ultimately" replace long-range bombers, interceptors and perhaps other current types, Gross stated, "For a long, long, long time to come there will be demand for manned aircraft in such fields as transport, patrol, distant early warning, reconnaissance, training, interception and types needed particularly to fight local or brush wars."

Lockheed's missile sales this year will total about $75 million, and Gross predicted, "they will double in the next two years." Lockheed's work force exceeds 5,000 on 17 missile projects.

Gross claimed Lockheed had "more experience than any other company" in the air launching of heavy missiles, flying of multistage ballistic missiles, flying of solid propellant missiles and interpretation of data telemetered from flying missiles to ground recorders.

His informal mid-year financial report predicted:

• **Sales of over $400 million** for the past six months, compared with $336 million for the same period last year. Increase is accounted for largely by higher commercial deliveries.

• **Earnings of $7.1 million** compared with $7.5 last year. Estimates for the full year range from $12 million to $17 million with $14 million predicted. This will be 10% below 1956. Electra writeoffs will be $18-20 million.

• **Backlog of $1.4 billion,** down about $200 million since Jan. 1.

Gross's presentation included these other points:

• **Orders for the Electra**—now totalling 136—have not grown so rapidly as Lockheed had hoped. "We are confident this total will more than double in the next year or so," and the Electra will be ordered steadily for the next 10 years. Lockheed wouldn't break even on present orders.

• **Construction** of the nuclear air science center for the Air Force is continuing in Georgia. Progress on the nuclear aircraft for which Lockheed has a weapon system management contract has slowed down pending design of a suitable reactor and shielding. It may be five years or more before real results will be forthcoming.

• **Airlines have ordered** 12 Super Constellations so far this year and orders are expected to continue at two per month through December.

• **Pitch-up and engine flameout** problems on the F-104 have been alleviated. Other problems are being worked on and deliveries to Air Defense Command are expected to begin late this year. Wide-range of earnings above reflects, for one thing, the F-104 delivery rate.

Industry Missile Role Defended

Washington—Aircraft Industries Assn. last week reiterated the determination of U. S. airplane manufacturers to hold on to their leadership in the face of a transition to the era of guided missiles (AW July 1, p. 26).

Orval R. Cook, retired USAF general and AIA president, made these points to support a strong role for the industry in the development and production of missiles:

• **Missiles have the same** "vital elements" as the airplane—an airframe, propulsion and guidance.

• **Problems of research,** design, production and materials are the same.

• **Government agencies have never been** successful aircraft producers, and there is no reason to believe they can manufacture missiles.

Legitimate Interest

Without mentioning recent testimony of the Army's Col. John C. Nickerson, Jr., in which he accused the Air Force and aviation industry of wanting to scuttle the Army ballistic missile program, Cook said the industry has a legitimate interest in the missile program.

In addition to its experience, he pointed out that it is imperative for the aircraft makers to shift to the new weapons if only in the interest of maintaining the nation's mobilization base. He said both the airplane companies and the government have invested hundreds of millions of dollars in airplane facilities and that most of them can be used to produce guided missiles.

On top of this, he said, the industry has a substantial reservoir of scientists, engineers and technicians whose talents are needed.

"We can see no reason," Cook said, "why their functions should be duplicated in either government establishments or the universities."

Redstone Arsenal

It was clear Cook had Army's Redstone Arsenal in mind as one of the "government establishments" where development work is being carried out in competition with the industry.

Col. Nickerson, a principal figure in the development of Army's Jupiter IRBM, made his charge against industry during his court martial for defying a Defense Department order giving USAF operational control over all missiles with a range in excess of 200 miles. He subsequently received the light sentence of suspension from rank for one year and a fine of $1,500.

On the subject of basic research, Cook said the universities can render "excellent services" but AIA believes they should be banned from development work, confine themselves to laboratory tasks and teaching.

In support of his case, Cook cited testimony of Lt. Gen. James M. Gavin, Chief of Army Research and Development. Gen. Gavin recently told a Senate appropriations subcommittee he would like to see a maximum amount of research conducted by industry and that an "intimate association" of the Army with industry "bodes well for our future."

MATS Reorganizes, Gets Additional Bases

Washington—Military Air Transport Service, new single manager for all Defense Department scheduled air transportation, reorganized last week to incorporate new aircraft and bases into its operation.

The new plan gives MATS two former Tactical Air Command bases—at Donaldson, S. C., and Larson AFB, Wash. Both will fall under jurisdiction of the Continental Division, which will absorb TAC's 62nd and 63rd Troop Carrier Wings with more than 100 Douglas C-124 Globemasters.

In addition, the Continental Division will take over Charleston AFB and Kindley AFB, Bermuda, formerly operated by the Atlantic Division.

At the same time, the Pacific Division of MATS, with headquarters at Parks AFB, Calif., will absorb the 1705th Air Transport Group at McChord AFB, Wash., taking over from the Continental Division and will fly all MATS trips to Alaska. Another Troop Carrier Wing of 24 C-124s will be assigned to the Pacific Division in Japan and moved from Tokyo International Airport to Tachikawa Air Base.

Atlantic Division, headquartered at McGuire AFB, N. J., will consist of two transport wings, two overseas support wings, three naval squadrons and two overseas support squadrons. Overseas wings will be located at Lajes Field, the Azores and Prestwick, Scotland.

The Naval Transport Squadrons now assigned to Atlantic Division will be VR-22 with 10 R6D Liftmasters and VR-3, now being moved from Moffett NAS, Calif., to McGuire.

Under the system MATS will perform missions for all Defense Department agencies and charge them for the service under an industrial funding program. President Eisenhower has asked Congress to transfer $100 million from U. S. Army stock funds to MATS to finance its operation starting next January.

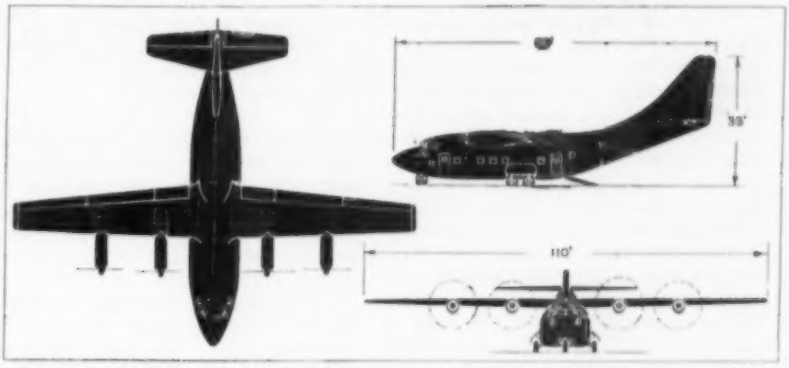
Independents Propose New Cargo Plan

By L. L. Doty

Washington—Proposal for a six-cents-per-ton-mile all-cargo commercial service using a fleet of 60 assault transports quickly convertible to a combat airlift will be presented to the Civil Aeronautics Board, Air Force and Congress by the Independent Airlines Assn.

The newly formed organization representing 44 active and inactive supplemental carriers has keyed its three-pronged program to the C-134 assault-transport and to a large-scale diversion of government cargo from the Military Air Transport Service to the irregular airlines.

The proposed project also embraces the handling of commercial freight and the movement of parcel post on a service pattern that includes small towns without adequate airports. It would be financed privately with additional funds to be drawn from traffic revenues as the service is expanded.



STROUKOFF C-134 is key to cargo service proposal. Six cents per ton-mile cost is promised.

How Plan Would Work

Here are the three principle features of the plan:

• **Independent Airlines Assn.** has explored commercial possibilities of the Stroukoff C-134 to reach its goal of six cents per ton-mile for freight traffic. Stroukoff Aviation Corp. has designed a four-engine version of the C-134 using either the Lycoming T55 or the Rolls-Royce RDa.6 Mark 510 Dart turboprop engines. Although the association is also interested in the current military version of the C-134 powered with two Wright R-3350 turbo-compound engines, it recognizes that "any future discussion of air freight must consider four-engine turboprop operations."

• **Operation of an equipment pool** by the independent airlines is proposed to handle freight movement backlogs through MATS and commercial cargo through freight forwarders who are now permitted to charter aircraft from the supplemental airlines as well as the scheduled airlines. The association also will call on other government agencies including the Post Office to utilize the proposed service.

• **Financing will be handled** through private sources by the individual carriers for initial payments on the equipment, with the balance coming from revenues as the aircraft become available and traffic increases. Stroukoff estimates delivery of the aircraft can begin within twelve months. Cost of each aircraft will be approximately $1.3 million.

The C-134 features a boundary layer control system that uses suction actuation of boundary layer over the whole span of the trailing edge of the wing. The system cuts landing and takeoff runs by about 40% and about doubles the coefficient of lift. Takeoff and landing distances are slightly less than 800 ft. for clearance of 50 a ft. obstacles (AW Jan. 7, p. 58).

The Pantobase all-surface landing gear permits landings and takeoffs on water, ice, snow and unprepared terrain.

The Pantobase skiis for landing and takeoff loads on snow or water use two stage shock absorbers that tend to return the aircraft to a level plane if one or the other wings should drop. The wheeled main landing gear for use on dry land is equipped with two tandem mounted wheels retracting into each side of the fuselage. Each wheel has a separate leg and shock absorber.

The C-134 has a total wing area of 1,235 sq. ft. and a wing span of 112 ft. It has a normal rated power of 2,600 hp. at sea level and a takeoff power of 3,500 hp. at sea level. Two four-bladed Aeroproducts propellers are used.

Equipped with either the T55 or RDa.6 turboprops, the C-134 will have an estimated Civil Aeronautics Administration gross takeoff weight of 81,500 lb. With the Lycoming T55, payload would average 25,000 lb. with a normal fuel load of over 12,000 lb. Block speed will be 250 mph. and the aircraft will consume 2,400 lb. of fuel per hour on an average 1,200-mile range.

Dart Payload Advantage

Using the Rolls-Royce Dart turboprops which generate 1,600 shp., the payload would total 32,000 lb. or 16 tons of cargo under an average fuel load of 16,000 lb. Block speed of the aircraft would average 290 mph., and fuel consumption would average 3,200 lb. per hour.

Stroukoff says all versions of the C-134 will handle freight traffic at six cents or less per ton-mile and meet all other operational requirements of the IAA. It would be adaptable to strategic or tactical requirements with only minor modifications.

Jesse F. Stallings, president of the Independent Airlines Assn. and of Capitol Airways, said today in a joint statement with Ralph Cox, Jr., IAA board chairman, that the proposal is "an outgrowth of long concern over the inadequacy of the nation's mobilization airlift reserve." They emphasized "the great need is for assault-type cargo transports, useful commercially as well as militarily, with adequate numbers of trained crews."

Log Jams

Stallings said the program can be accomplished without expense to the taxpayer and added: "It would give relief to recurring freight movement log jams that cost hundreds of thousands of dollars in delays to the defense program."

During the recent hearings before the Senate Subcommittee on Appropriations, it was brought out that the estimated cost of commercial transportation procured by military departments in Fiscal 1958 will amount to $245 million as compared with $219 million in Fiscal 1957. In Fiscal 1956, the cost rose to $170 million from $100 million the previous year.

However, traffic on aircraft under MATS control also showed a consistent rise from 85,082 tons of cargo and mail and 488,764 passengers in Fiscal 1954 to 123,808 tons of cargo and mail and 625,742 passengers in Fiscal 1955, according to the subcommittee's findings.

In his report to the Senate, subcommittee chairman Sen. Dennis Chavez (D.-N. M.) urged the Defense Department to give all commercial carriers a fair and equal opportunity to offer their facilities on a bid basis with

"equal access to information regarding commercial movements of cargo and personnel." He added:

"The committee desires that at installations where private carriers are permitted to offer their services for sale to individual personnel, representatives of all commercial carriers should be afforded equal access without discrimination."

The Independent Airlines Assn., formed by a merger between Aircoach Transport Assn. and the Independent Military Air Transport Assn. last May, is launching an aggressive program designed to divert more military traffic to its member carriers following a pattern set by the Air Transport Assn.

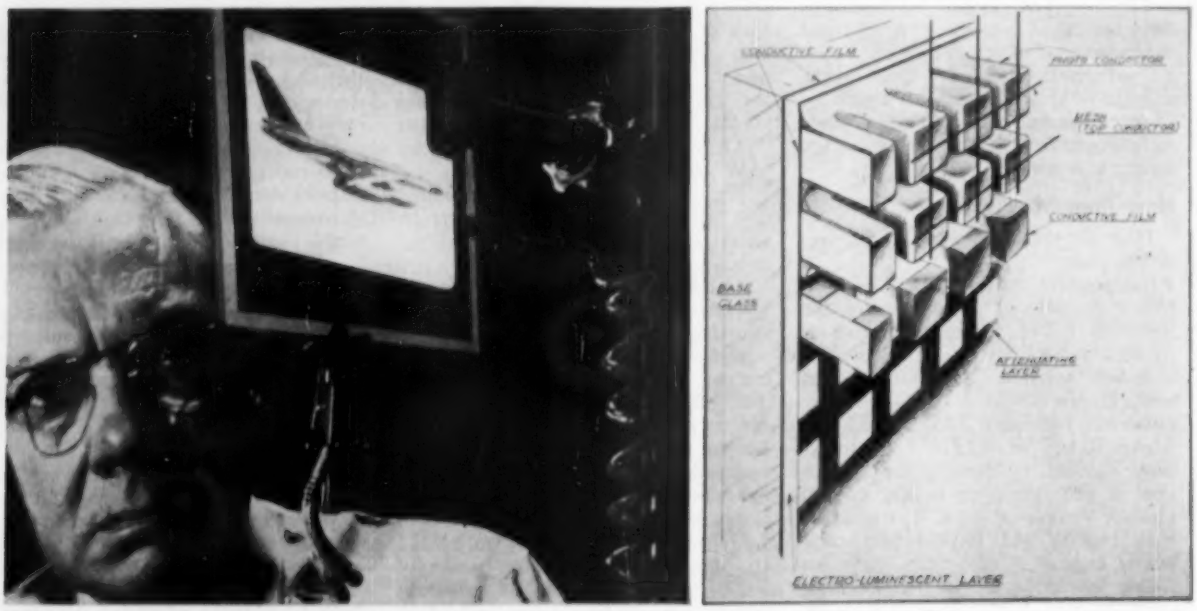
Under its present organization, the association can pool aircraft of the member carriers and bid for military traffic in competition with the scheduled airlines and surface carriers. The group feels that the cargo traffic potential will justify high utilization of the 60 C-134s.

Last week, the CAB approved an extension of agreement between IAA and the Military Traffic Management Agency of the U.S. Army, Defense Department's single manager for transportation, for the air transportation of personnel during the Fiscal 1958.

The legal status of the supplemental carriers is not yet clear as a result of a U.S. Court of Appeals judgment last year that vacated an earlier CAB ruling which gave the carriers temporary authority to operate as supplementals.

Oral arguments are scheduled to begin next month in the complicated Large Irregular Carrier Case which will be the first step toward legally defining the status of the nonscheduled carriers. Hearings on the applications of the individual carriers are not likely to be held until early next year (AW Feb. 25, p. 145).

At present, the carriers are authorized to operate unlimited domestic cargo and passenger charter service and operate a maximum of 10 flights in one direction between any two points for individually ticketed passengers or waybilled cargo. The carriers also have authority to operate cargo charter flights on international routes.



THIN-PANEL RADAR display is one use for new electro-luminescent techniques developed by Sylvania. Image converter is shown left. Light-storage panel construction is shown right.

Thin-Panel Radar Possible With Electro-Luminescence Technique

New York—Recent advances in combining electro-luminescence and photo-conduction techniques, opening the way to thin-panel radar displays instead of the bulkier cathode ray tubes now used, were reported here last week by Sylvania Electric Products, Inc.

Electro-luminescence is the generation of light by application of an electric field to certain types of phosphors, contrasted to the light created when hit by an electron beam as in a conventional cathode ray tube.

Sylvania demonstrated three types of thin-panel displays which employ electro-luminescence and photo-conduction:

- **Middle-dot panel,** which creates spot of light (such as radar target blip) at any location on the panel by applying an a.c. voltage to appropriate vertical and horizontal conductors of a grid.
- **Light-storage panel** which can store indefinitely the track of a spot of light traced over its surface. The image remains until electrically erased.
- **Image converter panel,** which displays visible half-tone image on one side when other side is illuminated with infrared image, visible light, or painted with electron beam. Device has sufficiently rapid response to produce moving images with good resolution.

Two possible combinations of these three techniques, suggested by Sylvania, include:

- **Combination mobile-dot and light-storage panel** could provide device for converting electrical input signals into visible spots or tracks for displaying radar targets.
- **Combination mobile-dot** and image converter panel could be used for TV-type presentation.

However, a Sylvania spokesman emphasizes that the devices are just out of the laboratory and that any TV-type thin-panel display is "four or five years and several million dollars away."

Sylvania has produced the electro-luminescent panels in sizes up to four inches square and is producing larger units for certain military applications.

The company says limited quantities of its new panels will be available to

selected laboratories on a priority basis for application to military systems. Massachusetts Institute of Technology's Lincoln Laboratory (Air-Defense) sponsored part of the Sylvania program.

The mobile-dot panel consists of a glass or metal square, alternately coated with horizontal conductors, spaced 16 to the inch, and a layer of electro-luminescent material, followed by vertical conductors. An a.c. voltage connected to any combination of one horizontal and one vertical conductor produces a spot of light at the intersection of the two conductors.

The light-storage panel (see sketch) consists of a glass base viewing screen which is coated first with a conductive film, then a layer of electro-luminescent material. A series of small glass columns ($\frac{1}{32}$ in. square, spaced $\frac{1}{32}$ in. apart) are next attached to give a waffle-iron appearance. Each of these glass columns has a conductive coating on either end, joined with a layer of photo-conductor material. A metal mesh is then attached to the tops of the glass columns.

When an a.c. voltage is applied between the metal mesh and the conductive film separating the glass base and electro-luminescent material, the panel is ready for operation. Shining a spot of light momentarily on any one of the glass columns causes its photo-conductive material to transmit the potential from the mesh to the conducting film under the column. This applies the a.c. voltage across the electro-luminescent layer directly underneath the glass column, causing this area to glow, creating a light spot visible through the glass base. Illumination from this spot in turn maintains the column's photo-conductor in a conductive state so the light spot remains after the original light source has been removed. Removing the a.c. potential applied to the panel will cause the spot to disappear.

The image converter is a sandwich consisting of a glass base, coated first with a conductive film, an electro-luminescent layer next, a photo-conductor layer and finally another layer of conducting film. When a.c. voltage is applied across the two conducting films, any image projected on the back of the panel (or painted by an electron beam) will appear as a visible image on the reverse side of the panel. The tiny phosphor elements have an excitation time of about one millisecond, a decay time of about three milliseconds.

Representatives from Radio Corporation of America and Westinghouse Electric, among those from industry who attended the Sylvania demonstration, told AVIATION WEEK that their companies also are developing electro-luminescent displays. General Electric also is believed to be interested.

Senate Restores $380 Million To USAF, Navy Procurement

By Katherine Johnsen

Washington—Senate last week restored $380 million of the $474 million cut by the House in new funds for Fiscal 1958 aircraft and related procurement by USAF and Navy as recommended by its Appropriations Committee.

The defense budget is now pending before a joint House-Senate conference committee to compromise the differences between the two versions as passed by the House and Senate.

The total $8 billion approved by the committee, however, is still $94 million below the administration's request and over $901 million below the new money allocation for Fiscal 1957.

The Senate restorations, even should the House agree to accept them, which is unlikely, actually have little significance if the administration goes ahead with plans to:

- **Hold down defense expenditures** to keep within a $38 billion ceiling for Fiscal 1958 (AW July 1, p. 26). At the present rate, the expenditure will reach $42 billion.
- **Hold back funds** for new contracts as a means of holding down expenditures in Fiscal 1959 and later years. Funds appropriated by Congress must be "apportioned" by the Bureau of the Budget. This gives the administration's top fiscal policy makers a close rein over the defense program. At present, approximately $5 billion in appropriated funds have not yet been "apportioned" to the services.

Aircraft Funds

The aircraft and related procurement funds voted by the Senate were:

- **USAF, $6.1 billion** as compared with $6.8 billion for Fiscal 1957. The Senate group said the $280 million it added will provide "minimum" requirements for aircraft spares, prevent a stretching out of the missile development test program and the introduction of missile systems into the inventory and allow for aircraft modernization. These are the areas in which the House applied its $354 million cut. No reduction was made in USAF's request for $2.7 billion for procurement of 1,515 aircraft during Fiscal 1958.
- **Navy, $1.9 billion,** $179 million more than the Fiscal 1957 allocation. The Senate group restored $100 million of the $120 million reduction by the House in order to permit "an acceptable level" of aircraft and related procurement. The House cut $70 million to try and pressure the Bureau of Aeronautics to increase its "recoupments" (savings from downward pricing and other economy steps) by this amount. BuAer reports, though, that it will be difficult to attain its estimated recoupments of $165 million for Fiscal 1958. The other House cut was $50 million for test quantities of Navy's two supersonic all-weather fighters, the McDonnell F4H-1 and Chance Vought's F8U-3.

R&D Funds Restored

The modest cuts the House made in Army, Navy and USAF research and development requests to encourage more "selectivity" of projects were restored by the Senate group. However, the amounts approved, already had been sharply cut by the administration to a point below what the services considered minimum programs.

USAF's request of $838 million was reduced by the administration to $661 million; BuAer's from $227 million to $165 million, and Army's from $596 million to $400 million.

The Senate endorsed House action in providing $21.5 million to finance the military phase of the Vortac air navigation system.

This amount was eliminated from the Civil Aeronautics Administration's budget.

Committee Demands

In its report on the defense budget, Senate Appropriations Committee directed two actions:

- **Prompt phasing out** of obsolescent weapons. The committee noted the "older traditional weapons must be retained until replaced by modern equipment" but added:

"On the other hand, . . . the services are reluctant to phase out obsolete and outmoded weapons and programs such as—notably—in the field of antiaircraft. The continuance of obsolete weapons and programs is an unwarranted waste of personnel and appropriations and should be eliminated immediately."

- **Increased use of airlines** in handling military traffic. The committee called on the Defense Department to revise its program so that civil air carriers would handle "as nearly as possible" 40% of the passenger requirements and 20% of the cargo requirements of the Military Air Transport Service. At present, about 20% of MATS passenger traffic and 10% of its cargo traffic is being parceled to civil air carriers.

MODIFIED F-84Fs working as tanker/receiver team carry out high-altitude aerial refueling, which has been accomplished at speeds up to Mach .725 and at altitudes of 35,000 ft.

Thieblot Develops Tactical Refueling Unit

Washington—High-speed, high-altitude aerial refueling system designed for fast conversion of tactical aircraft into tankers is now being flight tested by USAF and its developer, Thieblot Aircraft Co., of Bethesda, Md.

Developed under a Wright Air Development Center contract, the system thus far has been flight tested at speeds of up to Mach .725 and at altitudes of 35,000 ft. Thieblot engineers hope to improve both the speed and altitude figures in subsequent tests being conducted from Andrews AFB here with a Republic F-84F. The system, designated the Tactical Air Refueling System, is packaged in a standard external store providing for either under wing or internal bomb-bay installation. General concept of the system is a pair of rigid linkages extending below the tanker aircraft.

The lower linkage has at its aft end a standard refueling coupling and formating device designed to accommodate existing probe installations. The upper member, which extends beneath the tank, external store or bomb-bay store, is a streamlined rigid member mounted on a landing gear type trunnion.

The entire unit can be extended or retracted within an estimated two sec. and is equipped with a system of limit switches that provide automatic retraction if the receiver aircraft slips from its pattern.

The unit also automatically retracts if the receiver aircraft makes its approach at too great a speed.

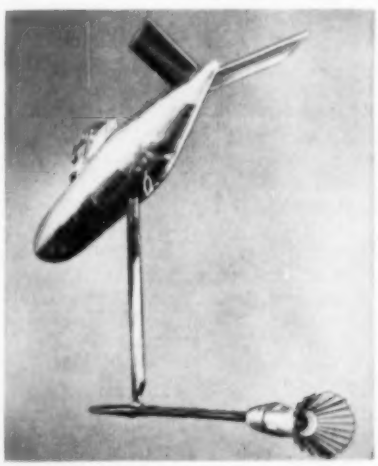
The package contains a complete hydraulic system and fuel pumping system. For external installations, the store is provided with a ram air turbine driving a hydraulic pump.

Mounted externally, the turbine runs continuously; internally, it is driven by ducted air flow.

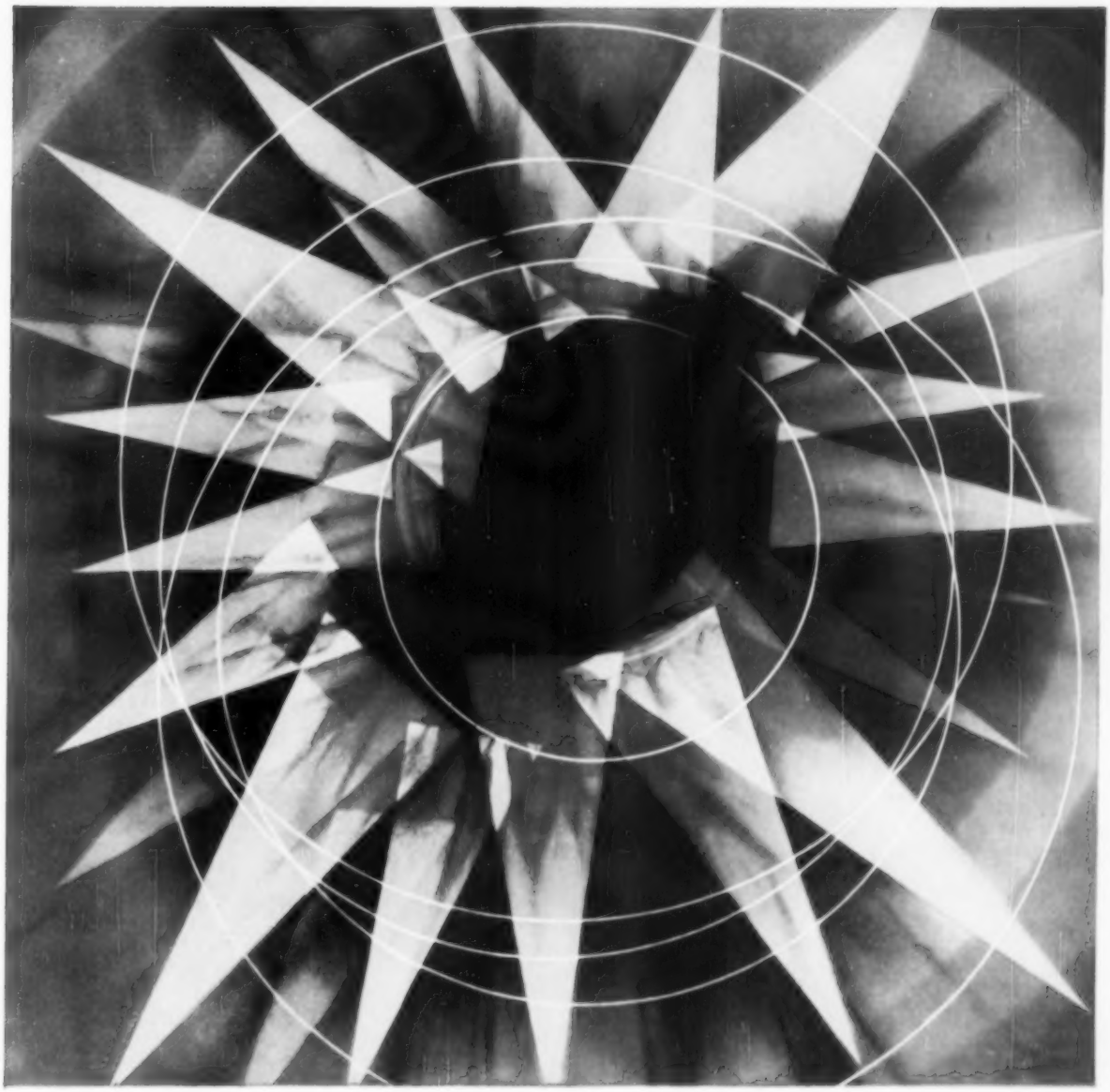
The fuel system consists of a standard refueling pump driven by a hydraulic motor. The system is dependent upon the parent aircraft only for a small electrical control power load. Pilot controls consist of a pipe unit extension, retraction switch and a fuel pump switch.

The store itself, having the external dimensions and mounting provisions of existing external store units, can be quickly attached to any compatible aircraft. Aircraft modification consists of only the addition of control wiring.

As conceived by Thieblot, the system would consist of a family of packages containing many interchangeable parts and designed so that they could be installed on existing external stores pylons and internal or bomb-bay type racks. They would be designed to accommodate current and future fighters, fighter-bombers and bombers.



TWO-SECONDS is all it takes to retract or extend refuel drogue on end of strut.



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Today's challenge lies in developing *metals* and *means* of cracking the thermal barrier.

The metals problem has already been partially solved by superalloys produced through Vacuum Melting. This process, as developed by Utica, has yielded such super refractory alloys as Udimet 500—a clean, pure alloy combining unsurpassed stress-rupture life with superior high tensile strength in the 1200° F to 1800° F range. *At 1600° F, Udimet 500 has a tensile strength of over 100,000 PSI.*

In addition to making new superalloys, Utica Metals Division of Kelsey-Hayes upgrades existing alloys through vacuum melting. Kelsey-Hayes Co., Detroit 32, Michigan.

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Beware of the Snark!

The nation's first intercontinental missile . . . the Air Force's Northrop Snark SM-62. Equipped with a nuclear warhead, the Snark is a so-called air-breathing missile which travels in the earth's atmosphere. Its compact design presents a smaller target for radar, interceptors, or anti-aircraft missiles.

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The pilotless bomber is powered by a Pratt-Whitney Aircraft J-57 turbo-jet engine equipped with a Holley compressor bleed governor. It flies in near-sonic speeds above the weather over the longest range yet possible by a missile in the free world today.

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KC-135 Goes Into Operational Use

Two aircraft, the first Boeing KC-135 tankers to go into operational service, were delivered to the 93rd Air Refueling Squadron at Castle AFB, Calif. Powered by four Pratt & Whitney J57 engines, the KC-135 can exceed 600-mph. speeds and 35,000-ft. altitudes, eliminating wasted fuel and time that had been required for jet bombers to rendezvous with piston-engined tankers. Flight maintenance and crew training courses will be conducted at Castle for SAC personnel. Several KC-135As have been delivered to the Air Research and Development Command and are undergoing testing at Wright Air Development Center.

Smith, Nyrop Detail Airline Fiscal Pinch

Airline presidents say that decline in profit margins poses threat to jet age financial obligations.

By Ford Eastman

Washington—Two U. S. trunkline presidents have issued warnings that the decline in profit margins may affect commercial airlines' ability to meet their financial obligations of the jet age.

Both presidents, C. R. Smith of American Airlines and Donald W. Nyrop of Northwest Airlines urged the Civil Aeronautics Board to grant the proposed 6% fare increase as a temporary relief measure until the General Fare Investigation is completed.

Both say that the price the industry can charge for its product—air transportation—is regulated and is actually lower than it was in 1938, while the cost of providing the product has increased many times over. Every phase of the air transport business has grown tremendously, but the price of tickets has remained static, they point out.

Why Increase Needed

"Whether or not the airlines can continue to operate with profit, and thus be able to meet their financial obligations, has become a matter of widespread concern," Smith told the Board. "If profits are inadequate, the ability of airlines to meet the obligations of the jet age will be seriously impaired. The present trend, if continued, will require airlines to look to the government for aid, through the resumption of subsidy payments.

"It is not, in our opinion, in the public interest that the taxpayer should again be asked to subsidize airline operation when that can be avoided by the authorization of fares which will permit adequate earnings.

"There is good reason to believe that the public is willing to pay a fair price for airline service. There have been several substantial increases in fares for rail and bus transport. A reasonable increase in airline fares can be accomplished without adverse effect on the normal growth of air travel, or unfairness to the traveling public."

Nyrop said the passenger fare in 1938 averaged 5.32 cents a passenger-mile, while the average fare in the first nine months of 1956 was 5.29 cents a passenger-mile.

When, he said, the decreased value of the dollar is considered it is evident that the cost of air travel has been substantially reduced. Meanwhile, the quality of the product has been vastly improved, not only in speed but in comfort, convenience and safety as well.

Nyrop, in a speech before the Midwest Institute of Transportation in St. Paul, Minn., cited an example of the cost increases confronting the industry.

"For example," he said, "aircraft engine parts, one of our largest cost items, increased 15% in May, 1951, 7½% in September, 1951, 7% in 1952, 5% in 1954 and another 5% in February this year. This means the engine part cost index is now 147% of 1951.

"Similar increases have occurred in the price of gasoline. Domestic gasoline at 1956 volume will cost about $600,000 more in 1957. Since we are flying about 15% more this year, we will pay about $700,000 more for gasoline than we would have paid at last year's prices.

Labor Cost Increase

"Labor costs also continue to rise. The most recent settlement negotiated with our union personnel will add about $1,700,000 to 1957 costs.

"In the days of the Lockheed Lodestar, airplane cost per seat at the time of original purchase was approximately $6,000. With each improvement in equipment, this cost mounted. For the DC-4 it was $8,700; the DC-6, $11,000; the DC-7, $24,000, and today we are confronted with the necessity for purchasing jet equipment at a cost of about $46,000 per seat.

"But the mounting costs which face us with our existing equipment tell only part of the story. When the problems of the jet age are considered, it becomes even more evident that the airlines face an economic crisis."

"This year," Nyrop said, "and during the first few months of next, Northwest is taking delivery on 24 new aircraft. The total cost of this equipment is $57 million. Meanwhile, however, although the last of these new planes will not be delivered until April, 1958, we are now confronted with necessity of ordering and making down payments on the jets that will replace them in 1960.

"Long range jet airplanes such as the DC-8 or the Boeing 707 will cost in excess of $5 million each, almost double the cost of the planes we are receiving this year and almost four times the cost of a DC-6B.

"Spare engines for these aircraft, and we must carry two for each airplane, will cost approximately $225,000 each as compared with the $40,000 which we now pay for DC-6B engine spares.

"In addition we estimate that the ground equipment and facilities, and new equipment for our overhaul base, required to support a jet fleet, will involve an investment of about $4.5 million.

"When you consider that the jet era will call for airline expenditures of $2.6 billion, you must sympathize with

Air France Will Order More Caravelles

Paris—Air France will shortly place a new order for at least twelve Caravelle twin jet airliners.

The state-owned carrier originally ordered 12 Caravelles early in 1954 and at same time took option on 12 more. Air France directors are meeting tomorrow and will shortly thereafter announce company's intention to pick up the option. There reportedly is a good chance company may announce further options on Caravelle.

Air France decision will bring to 30 the number of firm Caravelle orders placed to date. In addition SAS optioned 19 Caravelles when it placed its firm order for six aircraft (AW July 1, p. 40).

Sud Aviation, builder of the Caravelle, currently is negotiating with half a dozen companies representing airlines of Europe, Latin and North America. Near firm order for five Caravelles by Varig, Brazilian line, has been complicated by recent changes in Varig's board of directors. In Europe, Sabena seems to be closest of several lines in placing order.

In revealing SAS order Sud Aviation made no mention of the total sales figure, which reportedly works out at $16,800,000 including spares. Contract was signed in Paris for SAS by its president, Henning Throne-Holst, who was brought to Paris by a special Caravelle flight.

Throne-Holst said SAS will use Caravelle in mixed first class-tourist version carrying 70 passengers. He said SAS will use the Caravelle both on its European and near east routes which, he said, are exactly fitted for plane like Caravelle.

the airlines which must find the money."

Nyrop said the major sources of money are dependent upon equitable fare levels and the rate of return allowed.

As for new equity financing, he said the present stockholders would be reluctant to approve new issues until the ratio of market price to book gets above 100%, and such a rise depends on earnings.

Borrowed capital, he said, is available to the extent that lenders insist on a ratio of borrowings to equity that at least approaches the rule of thumb of one to one in other industries.

Big Four

However, he added, compare this with the 2.6 to one ratio that exists among the Big Four trunklines, where about $284 million of debt will be incurred to finance jet purchases, against an average net worth of $109 million.

Northwest Airlines was one of the seven carriers that filed for the 6% fare increase.

Other airlines applying were Capital, TWA, Delta, Eastern, Braniff and United.

American did not apply for the increase, Smith said, because it was believed the General Fare Investigation would be concluded by late this year.

Meanwhile, hearings in the suspended passenger fare increase proceedings continued last week with airlines cross examining bureau counsel witnesses.

The CAB staff has presented testimony and exhibits designed to show that airline operating results in the past and probable future results do not justify a fare increase.

New Policy

The CAB staff introduced in this case a new depreciation policy which in effect reduces expenses and inflates profits by recognizing a 25% residual value for piston-powered aircraft instead of 15% used in previous rate cases.

The CAB staff and airlines also differ as to operating expense, investment base and rate of return. By adjusting the operating expense listed by airlines, the staff has reduced costs from $1 million to more than $9 million dollars. Also by using a lower investment base the staff figures show a rate of return much higher than the airlines indicate in their exhibits.

As a result of the exhibits, profits estimated by airlines for 1957 have been greatly increased by the staff.

Trans World for example, forecasts a $100,000 loss for the year, while the staff estimates a net operating income of more than $28,000,000 for the air line.

Examiner's C&S Mail Rate Plan Could Cost Delta $1.8 Million

Washington—Civil Aeronautics Board Examiner Edward T. Stodola has recommended a reduction of $1,795,000 in mail compensation paid Chicago and Southern Air Lines between 1948 and 1952. The airline that could be hurt by the recommendation is Delta which absorbed C&S in a 1953 merger.

The examiner's recommendation is $552,000 less than the amount previously suggested by the CAB bureau counsel but approximately $1 million more than Delta would have been required to turn back to the government under the Supreme Court's original "offset" decision.

Stodola took sharp issue with several of the findings by the bureau counsel and warned that capital financing for jet age requirements will call for a 10% return on investment for the carrier rather than the 7% urged by the bureau counsel in supporting his $2,347,000 recommended mail pay recapture.

Stodola based his rate of return figure on the "need of a strong earnings position for Delta to attract additional capital funds on reasonable terms" to help finance jet transport equipment requirements in the future.

He said Delta has "borrowing commitments for approximately $30 million of the capital funds it will need for equipment purchases in the near future." Stodola said the record shows that Delta earned a 7.4% rate of return during the year which ended on March 31.

In the CAB suspended passenger fare investigation, the CAB staff estimated a fully adjusted net profit after taxes of $7,546,000 for the calendar year 1957 or a 19.8% return on investment for Delta.

Stodola charged bureau counsel with an "apparent confusion" of past and future rates and the relationship of such rates to standard rate making procedures. He agreed that a difference in rate may be justified between the usual past period and a future period because of the difference in risk involved but said a complete departure from established principles of rate making is not warranted in considering a "past period."

In his conclusions, Stodola said there must be a relationship with past and future periods and that to impose a "keyhole" view of earnings for a limited period would ignore the relationship between the rate of return and capital attraction.

He added:

"It is manifestly inequitable and unfair to reexamine the period under review through hindsight and recapture all of the considerable revenue proposed for recapture by bureau counsel."

He termed the jet age a "great opportunity and a great risk" and prophesied that "properly financed and efficiently managed, the revolutionary equipment in prospect may bring a long era of stabilized industry earnings."

He said that "to deprive a carrier of adequate earnings in good years without taking into account its experience in poor years is certainly not conducive to the kind of investor confidence necessary to attract capital financing."

On the subject of rate of return, Stodola said the "Board itself has already called attention to the fact that the motor carrier industry has earned over 10% and that air transportation is 'more comparable to motor carriers than to other regulated industries in terms of all three elements of the profit pattern' and 'that the air transport industry is already materially handicapped in competing with other regulatory industries for capital.'"

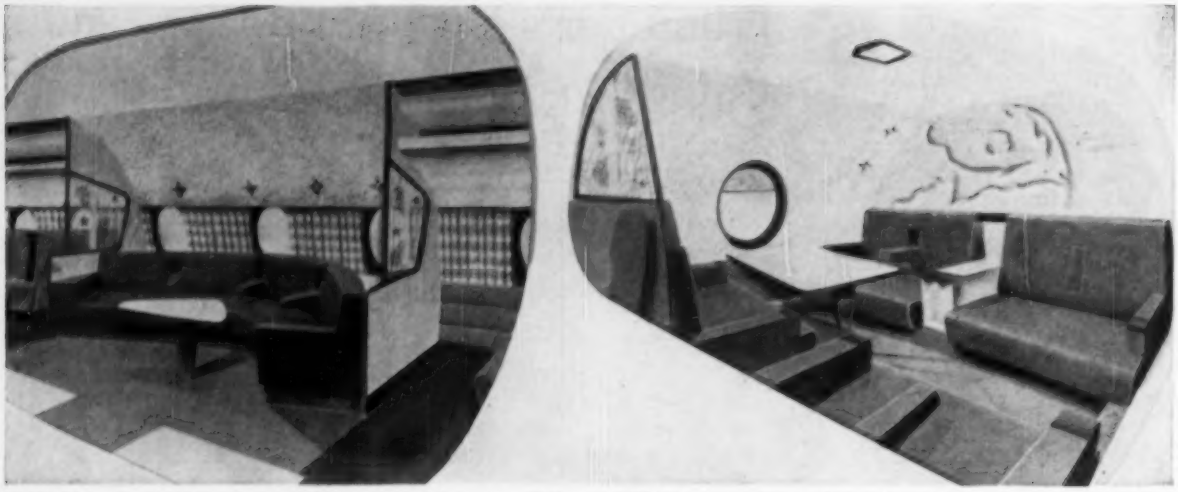
Stodola explained that the recommended mail pay reduction of $1,795,000 results from offsetting available excess earnings of C&S under domestic mail rates between Jan. 1, 1948, and July 31, 1952, and from reducing excess mail compensation paid to C&S for its international services from December 16, 1950, through July 31, 1952.

The total reduction of mail compensation for the carrier, he added, is subject to adjustment upon final determination of the question of the tax consequences of Delta's repayment of excess mail pay and to further adjustment depending upon the outcome of pending income tax controversies involving Delta.

Guest Sues Over Award

Mexico City—Guest Aerovias Mexico has been awarded a temporary injunction by a Mexican court against the Department of Communications award of the Chicago route to Compania Mexicana de Aviacion.

Guest claims to have held rights to the route since 1945 and says it has failed to exercise the rights because of the lack of an air agreement with the United States such as that recently concluded. A second court session, as yet unscheduled, will decide the outcome of the route battle.



CENTER four-seat lounge has a curved sofa (left), and translucent bulkheads separating it from the cabin. Step-down rear lounge (right) has chairs with pull-out arms, round windows, individual lights. All three lounges have yellow headliners, salmon seats and beige carpets. Small bookcase is placed between rear pair of seats in step-down lounge. Removable tables also may be installed.

How Northeast Plans Britannia Interiors

Three lounges have been designed for Northeast Airlines' fleet of five Bristol Britannias by Charles Butler Associates, New York design consultants. Firm executed planes' entire passenger cabin layout, decor and color scheme.

Forward lounge accommodates eight, the center, four, and rear has room for eight. All three lounges have light yellow headliners, salmon seats and beige carpets. This contrasts with the main cabin's light blue headliner, blending medium blue seats and dark blue carpets.

Gold Trim

Forward lounge has a long slash of gold trim at the indirect lighting level above the white hat rack, yellow curtains with a reddish stripe, and decorative Polyplastex covered doors leading to a forward buffet service area. Front bulkhead has driftwood finish. Removable tables may be installed between each pair of facing double seats for card playing or eating.

Center section features a gently curved, four-seat lounge running fore-and-aft in the plane. A modernistically-shaped table serves its occupants. The area is partially separated from the front and rear parts of the main cabin by translucent plastic half-bulkheads decorated with sea shells.

Step-down rear lounge is also partially separated from the main cabin by decorative plastic half-bulkheads. Sidewall, without hat rack, is gold-speckled Duracote vinyl-coated Fiberglas. Window rim is gold-colored.

Decorative motif is inscribed on rear bulkhead which is of driftwood finish. A small bookcase is placed between rear pair of seats.

Removable tables may also be installed between front and rear-facing seats for passengers' convenience.

Passenger Load

Northeast's Britannias will accommodate 49 passengers, first in two-and-two, then in three-and-two seats in the forward cabin plus 23 persons in three-and-two then two-and-two seats in the aft cabin for a total, including 20 in lounges, of 92 seats.

First NEA Britannia recently flew in England (AW June 24, p. 45), but start of service may be delayed by certification question on landing gear.

FORWARD lounge has eight seats, features curved back chairs, removable tables. Curtains are yellow and have a reddish stripe. Front bulkhead has driftwood finish.

Oral Arguments Slated In TWA Pilot Case

Washington—Oral arguments in the proceedings to suspend or revoke the airline transport pilot certificate of Leonard J. Specht, Trans World Airline captain for allegedly leaving an assigned altitude without permission (AW March 18, p. 30) will be held before the Civil Aeronautics Board on July 17.

Both Specht and the Civil Aeronautics Administration, which instituted proceedings, have appealed the examiner's initial decision. The examiner had ordered a six-months suspension of the pilot's rating.

In the appeal and request for oral

argument, the CAA said that, although the findings and conclusions of the examiner show that the respondent demonstrated a lack of qualification to continue to hold his rating, the examiner failed to revoke the license.

Capt. Specht said in his appeal that the examiner erred in "misinterpreting" and "misapplying" the emergency authority vested in the pilot in command.

The proceedings arose from an incident involving Capt. Specht who was in command of TWA Flight 19 en route from New York to St. Louis on Jan. 29 flying under instrument flight rules. The CAA charged that Specht was cleared to fly at an altitude of 14,000 ft. but that he left his assigned altitude in order to reach 18,000 ft. and climbed through 16,000 ft., the assigned altitude of Capital Airlines Flight 31.

Capt. Specht said he had declared an emergency because of icing conditions at his assigned altitude and had requested clearance at 18,000 ft. The attorney for Specht said there was no claim during the hearing that the controllers did not receive the emergency declaration, but rather the claim is they did not believe Captain Specht was in an emergency.

Tokyo Runs Planned By Philippine Airline

Manila—Two year expansion plan for Philippine Air Lines' regional and domestic operations has been submitted to the airline's board of directors by Col. Andres Soriano, president.

The program is to be undertaken from 1957 through 1959 and will be the first step toward resumption of PAL's long-range international flights, suspended in March 1954.

Reestablishment of flights from Manila to Tokyo is planned for October of this year, subject to approval by the Japanese government of a bilateral air treaty between the Philippines and Japan.

PAL also plans to increase its weekly flights to Hong Kong from the present six to about nine. Implementation of the new program will allow maximum economic utilization of the company's new Viscount aircraft, which will be used on its domestic trunk-line runs to Bacolod and Davao, where new fields are currently being constructed for this type of aircraft.

PAL will take delivery of its second Viscount shortly.

The company will retain its Convair aircraft primarily for use on its domestic runs, but they will serve as back-up equipment for the Hong Kong run.

The Convair will be converted from its present 340 type to the 440 Metropolitan type.

Urban League Charges Airlines Fail to Keep Pledge on Hiring

New York—Discrimination against Negro applicants for flight jobs in betrayal of a pledge made last year has been charged against 16 scheduled airlines by the Urban League of Greater New York. The airlines, all of them serving the New York area, issued a joint statement last October to the effect that applicants would be judged on qualifications alone.

Most airlines made no immediate comment. But it was pointed out that the pledge of October, 1956, was not a change of policy, but simply a reaffirmation of stated policy not to discriminate.

The League last week said it had sent letters to presidents of the carriers and attached a report citing 48 cases of applicants assisted by the League, all of whom had been rejected for employment. Fourteen Negroes have filed complaints with the State Commission Against Discrimination as a result of their experiences, the report notes. One case involving Trans World Airlines is scheduled for public hearing this week.

The 1956 policy pledge by the airlines, the report claims, "followed two years of intense efforts by the Urban League and others to eliminate what was always tacitly and sometimes openly recognized as an industry ban on Negroes in flight positions . . . despite the policy pledge . . . not one Negro has as yet been hired in any flight service capacity on any of the scheduled passenger airlines of the nation in any place in the United States."

The report notes that New York Airways has hired a Negro helicopter pilot. (New York Airways is a scheduled passenger airline.)

The League claims that R. F. Ahrens, United Airlines vice president-personnel, publicly has stated that the airlines are not yet ready to hire Negroes in flight jobs, and that H. L. Pollard, a United district personnel manager, indicated to a Negro applicant during an interview that even if his application were entirely acceptable, he would not be hired because of his race.

Since the October, 1956, pledge by airlines, the report states, stewardess applicants had been referred by the League to TWA, American Airlines, and United Air Lines. Seekers for pilot jobs were referred to Allegheny, American, Eastern, Capital, National, TWA and United. None were hired. Negroes referred for work as stewards and flight engineers "have fared equally as badly," according to the report.

The League's Airlines Committee commented in its report that "it is difficult to avoid the conclusion that all of the scheduled airlines of the United States are continuing, in concert, to maintain the rigid ban on the employment of Negroes in all flight capacities. . . . The next step is up to the airlines."

American Airlines said it had hired two out of every 100 stewardess applicants interviewed during the last year and that on a purely mathematical basis it was improbable that the two Negro applicants the League says it referred to American would have qualified. Like other airlines checked by AVIATION WEEK, American said its hiring policy was based on merit alone and cited examples of Negro employes in many jobs within the airline.

High Speed Blamed In TWA Accident

Washington—Excessive speed during an emergency approach contributed to the crash of a Trans World Airlines Martin 4-0-4 at Las Vegas, Nev., last Nov. 15 the Civil Aeronautics Board ruled last week. The captain, hostess and 14 of the 35 passengers received only minor injuries although the plane was damaged beyond repair.

The 4-0-4 had taken off from Las Vegas en route to Los Angeles when one engine lost power and the propeller was feathered.

The flight returned to the airport and appeared to be making a normal approach to the runway.

The CAB accident investigation report said the flight crossed the threshhold with excessive airspeed and floated 2,745 feet before touching the runway. A series of bounces occurred as unsuccessful attempts were made to force the aircraft onto the runway.

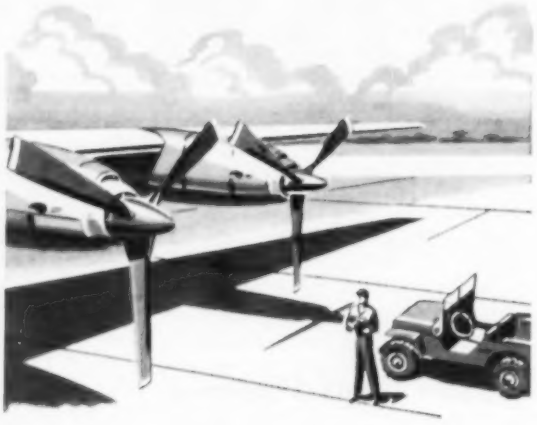
Believing the aircraft could successfully go around at the speed and in the configuration which existed, the report added, the captain attempted unsuccessfully to do so..

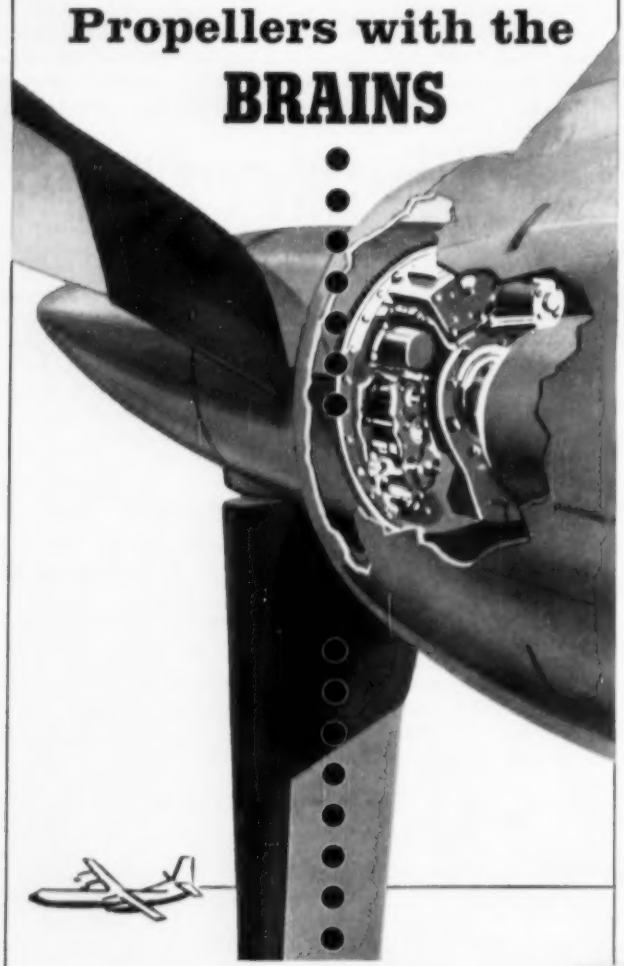
The Board determined that the probable cause of the accident was that in an emergency situation the captain failed to reduce speed during the latter portion of a single-engine approach. The excessive speed resulted in an overshoot and an attempted go-around which was beyond the performance capability of the aircraft under existing conditions.

The Board also said that prior to the accident, company pilot training with respect to single-engine performance of the Martin 4-0-4 in the balked landing situation was found to be inadequate.

Curtiss-Wright TURBOLECTRICS

Propellers with the BRAINS





Converting the power of the new gas turbine or "turboprop" aircraft engines into useful thrust is a most exacting assignment for the time-honored propeller. It has to handle just about double any previous power . . . smooth out fast accelerations characteristic of these engines . . . control their power by the subtlest amount of pitch change on the blades . . . reverse to slow down and stop the momentum of some hundred tons of airplane.

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A leader in powerplant design, Curtiss-Wright also leads today in translation of turbine power into useful propeller thrust.

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Ozark Primes for Expansion Program

By Craig Lewis

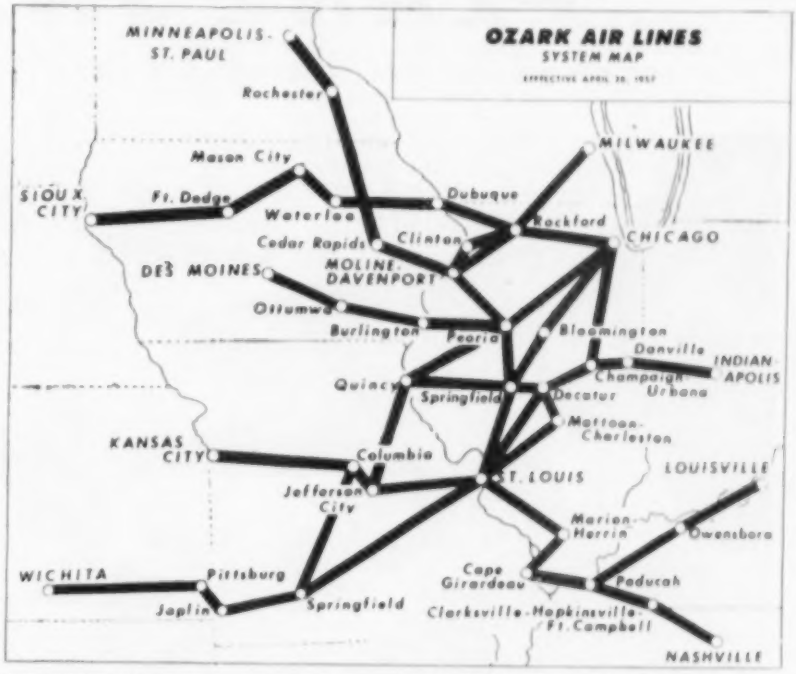
St. Louis—Ozark Air Lines is in the midst of a route expansion program which has seen the local airline inaugurate service on five new routes in the past two years.

Applications are now before the Civil Aeronautics Board which would add significant new mileage to the carrier's system in a program designed to blanket its Mid-Western territory.

In serving these expanding markets, Ozark is concentrating on the basic operating factor of reliable, on-time service in competing with both trunk airlines and some highly competitive surface transportation.

Like all other local airlines, Ozark relies on the DC-3 to provide this service. Unlike many other local carriers, Ozark has yet to order new equipment to replace the DC-3.

One of the youngest of the local service airlines, Ozark started operations in 1950. Since then, the carrier has moved up among the top half dozen local carriers in terms of traffic and revenues.



MID-WESTERN markets are served by growing Ozark Air Lines with DC-3 equipment.

Feeder Line

Ozark Air Lines was incorporated in 1943 to operate as a feeder airline, but authority didn't come from the CAB until 1950. At that time, the carrier took over Parks Air Lines and its system, and started service between St. Louis and Chicago via Springfield, Decatur and Champaign-Urbana, Ill. Chicago is still Ozark's best traffic point.

Two years ago, Ozark began serving a whole series of new routes. In May, 1955, service was started between Paducah, Ky. and Nashville, Tenn.; in August, 1955, between Chicago and Sioux City, Iowa; in October, 1955 between Paducah and Louisville, Ky.; and in June, 1956, between Peoria, Ill. and Des Moines, Iowa.

Latest service began April 28 on a new Moline-Davenport to Minneapolis-St. Paul route which adds the Twin Cities to Ozark's collection of substantial midwestern traffic markets. First months of operation indicate the latest route will be one of the carrier's strongest segments.

Addition of these routes has helped Ozark jump its traffic from a total of 156,391 passengers in 1954 to 247,031 in 1955 and 318,944 last year.

For future growth, Ozark's main interest now lies in the Seven States Area case. In this one, the carrier hopes to stretch its system west to Denver and to add such points as Omaha and Cheyenne to its routes.

Ozark would also like to go to such new terminals as Tulsa, Knoxville and Cincinnati. And the airline would also like a route link between Milwaukee and Chicago to improve aircraft scheduling in that part of the system.

Generally, none of these projected route expansions overlap present route systems of other local airlines. That is because Ozark doesn't believe local carriers should compete with each other.

Overlapping

Ozark's President Laddie Hamilton told AVIATION WEEK he thinks local airlines "seal our doom" when they start overlapping routes and competing with one another. He believes it would lead to increases in the already heavy subsidies now paid the local service industry.

Ozark hasn't decided which transport it will buy to replace its DC-3s, but Hamilton says the new aircraft will be turbine powered when the decision is made. Right now, the Fairchild F-27 is the "Number One prospect" in Ozark's view, but other aircraft are also in the running.

Vickers-Armstrongs has produced an extensive study of Ozark's system in plugging the Viscount, and the carrier has heard Sud Aviation's pitch on the Caravelle. The Handley Page Herald is another competitor. The final decision depends somewhat on whether the CAB decides to lift any of the local airlines' various route restrictions.

Hamilton feels that Ozark will continue to operate DC-3s on some routes even after a new airplane is acquired, and he says the carrier will probably buy more DC-3s if its route applications are successful.

In an effort to improve its present fleet of 20 DC-3s, Ozark has launched a modification program to improve DC-3 performance. The end-products of this modification program called Challenger 250s, began flying on the carrier's system over a year ago.

The modification program gets its biggest performance gain from new wheel-well doors developed by Pan American World Airways at its Brownsville, Tex. base. A new oil cooler scoop also helps reduce drag. Ozark performed these modifications at its St. Louis base.

The airline also cleaned up the DC-3 exterior by installing flush radio compass antennas. The DC-3s went to Aircraft Conversion Corp. in Detroit for wing filler fairing and aileron gap covers.

In the future, Ozark plans to add new engine cowling and baffling developed by AiResearch. Also in the future will be jet-type exhaust stacks. The Challenger 250 presently has short stacks.

When all modifications are completed, Ozark figures its DC-3s will be 20% more efficient. Airspeed gain is

PLANE FAX

by STANDARD OIL COMPANY OF CALIFORNIA

300-mile flight wins $1,000,000 job

Four hours before the deadline for placing bids on a million-dollar Nevada State road construction job, A. D. "Andy" Drumm Jr. took off from his home airport at Fallon, Nevada. In 3½ hours he had covered 300 miles, flown over the future road site to estimate the work involved, landed at Carson City and placed the low bid.

"Bumpy low-level flying, frequent take-offs from gravel strips, steep climbs in hot weather — we do it all," says Mr. Drumm, who is owner of the Silver State Construction Company. "But in several thousand hours in the air, we've never had any engine trouble, using RPM Aviation Oils. In fact, we usually put 1000 hours on a plane with only regular maintenance, then trade it in while it's still in top condition. When we do overhaul an engine, we've always found 'RPM' has kept it clean and held wear very low.

"This lets us get full power from Chevron Aviation Gasoline right up to trade-in time. Even on our rough, short strips it gets our Bonanza's and AT-6's upstairs with plenty of room to spare. Leans out for economy in cruising, too. It's the best fuel we've ever found."

TIP OF THE MONTH

With so much flying in Nevada's turbulent air, Mr. Drumm's planes are equipped with G-meters. His advice—*slow down* when bumps register plus-2 or minus-1 G's, or whenever it gets really rough.

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We take better care of your plane

T.M.'S "RPM," "CHEVRON," "PLANE FAX," REG. U.S. PAT. OFF.

estimated at about 25 mph., but right now the carrier is taking all its gains by operating at normal DC-3 speed with reduced power because of new pay demands made by Ozark pilots on the basis of increased speeds.

Discussing the local airline industry's subsidy problems, Hamilton said there are three solutions:

- **New equipment** to replace the uneconomical DC-3.
- **Greater operating** flexibility from the CAB so carriers can operate more profitable nonstop, long-haul flights.
- **Strengthening** of route structures by the CAB.

Hamilton feels that local airline fares are inadequate to cover cost increases. He points out that local fares are tied to trunk fares, and that if the trunks are successful in their efforts to raise fares 6%, the local airlines will follow. But he also points out that even 6% won't cover the situation long because of continually rising costs.

Six Eastern Nations Can Handle Jet Liners

Washington—Airways and airports in six Far Eastern countries will be adequately equipped to handle jet transport operations within the next two years, according to Joseph H. Tippetts, director of the Civil Aeronautics Administration's Office of Air Navigation Facilities.

Tippetts has just returned from an inspection tour of Formosa, Korea, Thailand, Viet Nam, Japan and the Philippines where he made a detailed survey of airway and airport development. The CAA has an average of five specialists based in each of the countries except the Philippines.

Tippetts said instrument landing systems, VOR facilities, high-density approach lights and non-directional beacons are being installed throughout the area to conform with International Civil Aviation Organization standards. The CAA is purchasing the equipment with funds provided by the International Cooperation Administration under a CAA technical assistance program.

The CAA official said runways of airports serving the capital cities of the eight countries are now being prepared so that length and width will accommodate jet transports scheduled over present airline routes.

Tippetts said the major aim of the assistance program is to train nationals in the maintenance and use of the equipment and added that "it is the CAA policy to suggest and demonstrate only so as to give the nationals a chance to develop technical competence through experience as well as training."

AIRLINE OBSERVER

► U. S. delegates to recent London talks on the proposed British-U.S. bilateral agreement lost some of their negotiating power as a result of sharp British criticism of the Civil Aeronautics Board's refusal to approve an International Air Transport Assn. proposal for a 5% increase in transatlantic fares (AW June 10, p. 45). For the fifth time since March, 1956, the U.S. failed to obtain operating rights for Trans World Airlines between Frankfurt and Paris to close the carrier's European route gap. Although the talks were originally billed as "exploratory" and not as formal discussions, it is understood that plans for further negotiations have been shelved as a result of the failure to reach any accord on the agreement.

► Civil Aeronautics Board hearings began last week on Sociedad Aeronautica Medellin's application for a foreign aid carrier permit to operate scheduled service over three routes from Colombia—to New York and Montreal, to Miami and New York and to New Orleans.

► Airlines last week implemented plans for flying under instrument flight rule clearances at 9,500 ft. or above on the "golden triangle" routes between New York, Washington and Chicago (AW June 17, p. 45). Both the Air Transport Assn. and the Air Line Pilots Assn. plan to lower the floor altitude progressively as the air traffic control system capacity increases. Airlines are now voluntarily operating all flights above 18,000 ft. throughout the U.S. under IFR procedures to maintain positive separation of aircraft. Civil Aeronautics Administration has established 24,000 ft. as the floor for positive control of aircraft under all conditions.

► Amendment to International Air Transport Assn. emigrant fare resolution permitting the application of a 40% rate discount to emigrants from Spain has been approved by the Civil Aeronautics Board. An earlier resolution calling for the discount applied to all European emigrants except those from Italy and Spain.

► American Airlines motion for "expeditious hearing" on its application to provide nonstop service between New York and San Francisco has been denied by the Civil Aeronautics Board. CAB staff, however, has been directed to review the problem of the air service pattern between New York and San Francisco and to report the results of the study to the Board on or about Dec. 1 to determine the need of an early hearing on the nonstop service issue.

► Hawaiian Airlines request for an exemption to permit the issuance of free transportation to one tour conductor accompanying 15 or more persons traveling as a group between points in the Hawaiian Islands on an advertised tour has been denied by the Civil Aeronautics Board.

► Reduced railroad fares for military personnel traveling in uniform at their own expense have been extended to June 30, 1958, one year beyond the previously scheduled expiration date.

► Alaska Airlines has joined the Assn. of Local and Territorial Airlines to bring the membership of the new group to nine. In addition to the six local service carriers which split with the Conference of Local Airlines over policy matters (AW April 1, p. 38), membership includes Reeve Aleutian Airways (Alaska) and Trans-Pacific Airlines (Hawaii).

► Convair Division of General Dynamics Corp. has delivered the 1,000th transport it has produced to Eastern Airlines. Customers have invested $600,000,000 in the Convair 440, 340 and 240 transports, the first of which was delivered in February, 1948. Fourteen domestic and 30 foreign airlines have purchased one or more of the three commercial versions of the two-engined transport.

► Australian government has approved the recently negotiated bi-lateral agreement with the U. S. granting Qantas Empire Airways operating rights between San Francisco and New York and beyond for an around-the-world route. Next step to complete the agreement involves a formal exchange of notes between the two governments to iron out details.

TCA reports...

61% TRAFFIC INCREASE WITH VISCOUNTS!

In the first nine months of 1956, Trans-Canada Air Lines' New York–Canada traffic rose 61% over the previous year—thanks to the Vickers Viscount.

The tremendous passenger appeal of the Viscount was evident from the very beginning. In the first full year of service, Trans-Canada Air Lines' total Viscount operations achieved a passenger load factor of 81%, and has averaged over 80% for more than two years of service.

Mr. Gordon McGregor, President of TCA, declares that, in his opinion, "the Vickers Viscount is by a very wide margin the best commercial aircraft of its class that has ever been built." He adds that both from the operations and traffic viewpoints, Viscounts "proved the ideal medium-range aircraft." As a result, TCA has ordered a total of 51 Viscounts.

Similar popularity is reported by all the 14 other airlines now flying the Viscount. Their experience proves again that *"wherever the Viscount flies, traffic figures rise"!*

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SHORTLINES

▶ **American Airlines** will begin the first nonstop service between Boston and Los Angeles on August 1 with Douglas DC-7s. C. R. Speers, senior vice president-sales, points out the service will give passengers traveling between the West Coast and Europe "an option of connecting at Boston rather than at another East Coast city, with appreciable savings in time in many instances." The airline also has completed a quarter-million dollar renovation of its passenger facilities at LaGuardia Airport, including doubling the space in ticketing and gate areas and installment of a self-claim baggage system. The facility will be used until completion of the Port Authority redevelopment program at LaGuardia.

▶ **Linee Aeree Italiane (LAI),** and Seaboard & Western Airlines have signed a cargo interline agreement permitting air cargo to fly over Seaboard's and LAI's routes on one airway bill.

▶ **Northeast Airlines** has inaugurated two services on its New England routes. The first three direct flights daily from Philadelphia to Martha's Vineyard and Nantucket. The service originates in Washington, it bypasses New York and continues on to Hyannis, Mass., and Boston. The second—a nonstop flight from New York to Portland using Douglas DC-6Bs. This also is on a three flights per day basis.

▶ **Avianca,** Colombian National Airways, will begin first class flights to Bogota, Quito and Lima on July 9, first time the capitals have been linked by one air carrier directly from New York. The service, operating on Tuesdays and Saturdays, will stop only at Jamaica. At the same time, Avianca will move the southern terminus of its European service from Bogota to Lima, providing Quito with the only air transport service to Paris and Frankfurt.

▶ **United Air Lines** has expanded its Douglas DC-6A all-cargo service to Boston and Hartford-Springfield. The new service provides westbound flights to the Midwest via Cleveland with connections in Chicago for cargoliner service to California. New eastbound service from California to Boston was also begun on July 1 with en route stops at Cleveland and New York.

▶ **Central Airlines** has inaugurated passenger service to Harrison, Ark., as a new stop on the Fort Worth-Dallas to St. Louis route. The Harrison service brings to 32 the number of cities served by Central.

COCKPIT VIEWPOINT

By Capt. R. C. Robson

State of the Weather

A study of available weather reports and forecasts generally provides a pilot with a fair idea of the meteorological possibilities which his flight may encounter. These possibilities are occasionally known to vary from one extreme to the other, so the wise pilot comes prepared for most anything.

This does not mean that today's meteorologists are not doing a fine job. They are and we need more of it. But still conditions in the sky are not always as advertised. How can we do better?

On some airlines, especially routes which have a high frequency of operation, the pilots run their own flight advisory service. For instance, 20 or 30 minutes out of Washington I may talk to a trip over New York at 14,000 ft., a local just north of Philadelphia and, if desired, flights in the vicinity of Hartford, Albany or Boston. The extent of our exchange of information depends on the need. A wealth of data is available including airport and en route visibility, wind, turbulent areas, the location and movement of rain showers and anything else needed.

Obvious Benefits

The benefits of such a system are obvious. Not only is safety increased, but we are also able to provide a more pleasant ride for the customers as well as operate a more efficient flight. It would be wonderful if all pilots in the area could share in these reports.

Here, of course, is the point of this column. The U. S. is blanketed with aircraft day and night. Put your finger on a map and chances are that an airplane is close by with the pilots actually observing the weather. What could be more exact than a system based on reports from these on the spot observers? It is probably fair to state that the aviation business would not be the only one to gain from such a plan.

Once upon a time there was a belief in aeronautical circles that pressurized cabins would allow "over the weather" flying in the most literal sense. For obvious reasons this belief was short-lived. Supercharged engines and pressure systems certainly do allow more latitude in choosing the flight path but we have not yet risen to Utopia. With each successive increase in altitude we seem to meet new problems.

Greater Demands

Within a few years air transportation is apparently going to fly even higher than it does now, and at considerably increased speeds. If anything, this sets a requirement for even more detail about weather conditions aloft.

Pilots want to know the exact direction and velocity of upper winds, the precise location of the jet stream, whether clear air turbulence exists and where, what icing they will find, and many other things. Forecasts, while useful, will not satisfy the urgent need to know what is happening right now.

Obviously when we boil this down we find that we are talking about a communications problem. The ultimate can not be achieved on today's radiotelephone circuits. On the other hand the need for an up to the minute, in-flight pilot advisory service is a real one and some steps might be taken now towards the organization of a centralized weather reporting system.

I certainly want to know what's ahead so that I can plan accordingly. I suspect my passengers would like this also. Jet flights would appear to gain enormously from this data. Quite properly, I suppose, the CAA might initiate exploratory talks on this subject since everyone is vitally interested in it. Many pilots, airline, business, private and military feel that this would be a worthwhile project. Who knows, we might even *know* what the weather is some day!

NAVY
59

T2V-1 SeaStars will soon go into service with the Naval Air Training Command

9 OUT OF 10 U. S. MILITARY JET PILOTS WERE TRAINED IN LOCKHEED JETS. THE NAVY'S NEW T2V-1 "SEASTAR", BUILT BY LOCKHEED'S CALIFORNIA DIVISION, IS THE FIRST U. S. PRODUCTION PLANE WITH HIGH-SAFETY BOUNDARY LAYER CONTROL.

— — — — —

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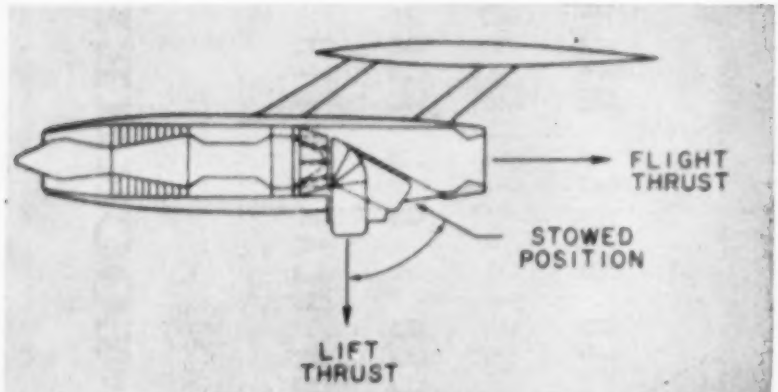
X-14 makes conventional flights with the exhaust jets of the two engines, directed rearwards and VTOL flights with the jets directed downwards. It has not yet performed an inflight transition. Small air nozzles at wing tip and tail are for slow speed control. Dimensions are: span 34 ft., length 25 ft. and height 8 ft. at tail. Takeoff weight is probably just under the 3,500 lb. maximum thrust of the engines minus any turning losses. Fuel tanks are fixed under the wing as a matter of convenience; they are not droppable.

X-14 Flies; Transition Test to Follow



DEFLECTING tailpipe was proposed by Bell designer, the late Robert Woods, in an SAE paper. Although a Bell spokesman familiar with the X-14 has pointed out that this does not disclose the exact nature of the jet turning device used on the X-14, the drawing does indicate how Bell might do the job on a future jet VTOL. Device used in the restricted space on X-14 could very likely be a series of cascade turning vanes. Such a device has features in common with thrust reversers and, like them, has the practical problems of actuating and sealing a device which must work in the hot exhaust gas environment. If afterburning were used, the problems of nozzle area and fuel control would be added.

Bell aircraft's X-14 jet VTOL has successfully completed initial flight tests, short flights in both conventional and VTOL regimes. Next step will be transitions from VTOL to conventional flight and back.

The Bell-USAF sponsored X-14 is a cleaned up version of the wholly Bell sponsored VTOL flown in 1954. Instead of bodily rotating the engines as on this first VTOL model, Bell has the jet engines in the X-14 maintained level and their exhausts are deflected down for vertical flight.

Viper Powerplants

The X-14 is powered by two Armstrong-Siddeley ASV.8 Viper turbojets producing 1,750 lb. thrust each. Special vanes or diverters bend the two jet exhausts downwards.

When a safe altitude is reached by the aircraft the vanes are "feathered" to direct the jets rearward for conventional forward flight.

During the vertical and transition

TEST PILOT David Howe made the first X-14 hovering flight. The exhaust jets of the two side-by-side Viper turbojets are located in the center of the triangle formed by the red turbine warning line around the fuselage and the two main wheels. The exhaust jets and their deflecting mechanism are hidden from view by the fixed fuel tank hung below the wing. Long legs of the landing gear minimize the ground influence on the exhaust jets.

flight periods, aircraft control is effected by three air jets, one at each wing tip and one at the extreme tail.

In design the X-14 appears a natural evolution of the first Bell VTOL experimental aircraft now in the Smithsonian Institute, Washington, D. C. That design used two Fairchild J44 engines in rotating "ash-cans" to lift and propel an airframe made up of a Schweitzer glider fuselage and a Cessna 170 wing.

The new aircraft has nearly twice the weight of the first VTOL, 3,500 lb. against 2,000 lb., and has a much more finished appearance. X-14 is still a low speed test vehicle: high drag of the cockpit indicates that Bell and USAF are only interested in learning more about VTOL and transitional flight rather than exploring the high speed potential of this design.

Because the Vipers have a thrust to weight ratio of about 3.4 and a SFC. of 1.1 against the older J44's thrust to weight of 2.7 and SFC. of 1.55, the X-14 is able to stay aloft about 30 minutes compared to the 10-12 minute hops accomplished by the first VTOL.

Ultimate foreseeable vehicle of this type would use turbojets of the new lightweight class as the Fairchild J83 or General Electric J85. The more advanced J83 and J85 engines are expected to have thrust to weight ratios of 8:1 and SFC. as low as 0.88 and therefore ought to provide future vehicles of this type with durations of up to one hour.

Later Engines

If the afterburning versions of these newer engines are used, Bell engineers believe that it ought to be possible to design a competitive supersonic NATO type fighters having VTOL capabilities.

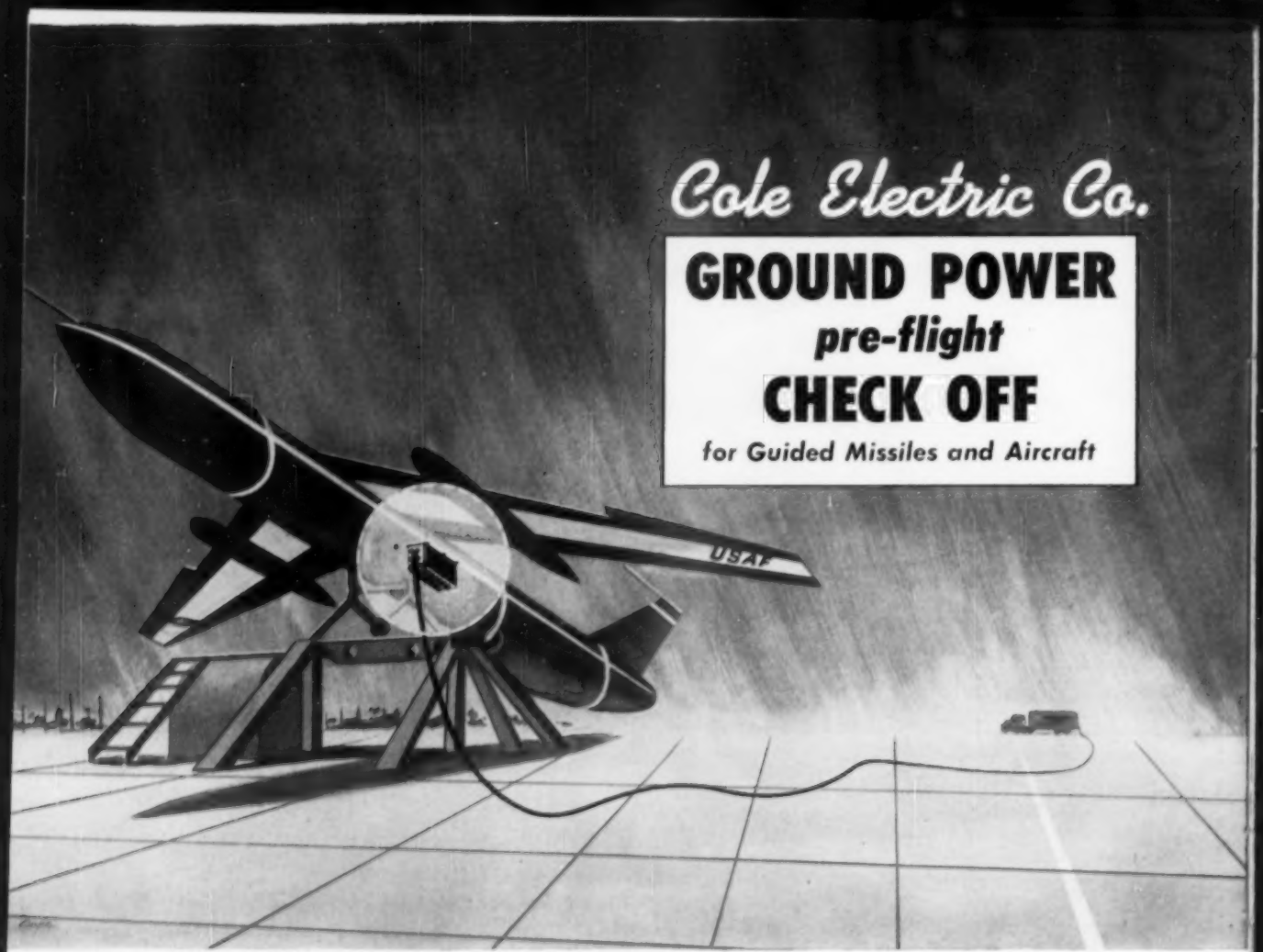
In a paper presented before the Society of Automotive Engineers over a year ago, the late Robert J. Woods of Bell described (among other Bell VTOL interests) a jet transport which would use the deflecting tailpipe principle. The configuration he described was expected to be good for supersonic speeds up to Mach 2. An internal valve-tailpipe between the jet engine and horizontally fixed afterburner was pivoted down for the VTOL lift-off.

Once airborne, this short intermediate tailpipe was turned back in line with the conventional afterburner for Mach 2 forward flight.

Woods said that while the tilting nozzle might use its own afterburning for take-off, VTOL landing probably could be accomplished without afterburning since the fuel load would have been lightened.

The four-engined transport contemplated had a 4,000 lb. payload and a range of 800 miles. It was expected to have a terminal hovering allowance of 6 min.

Because conventional landing gear was retained, the transport operator would have the option, if space permitted, to increase his range (or alternately payload) by using a rolling take-off. In Woods' example, a 1,500 ft. ground run permitted 30,000 lb. over-



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The switch-over from ground to airborne power is achieved at take-off with a Cole Miniaturized Automatic Electrical Substation (patent pending) transferring all electrical and electronic circuits in seconds. Weighing only 30 pounds, the unit eliminates all relays, coils, cores, magnetic armatures and vacuum tubes. It consumes no airborne power.

Inquiries regarding this equipment are invited from qualified military personnel, missile and aircraft manufacturers only. Write for full details and technical data to: Cole Electric Company, 8439 Steller Drive, Culver City, California.

For many years Cole has manufactured metal clad switch gear with internal instrumentation and power switching... know-how which is applicable to this new purpose.

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400 Cycle, 3 Phase
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load of fuel to be carried, increasing the range to 1,300 miles.

The X-14 was designed around the practical necessity of keeping the vertical thrust working through the aircraft center of gravity at the one-fourth wing chord. This meant that the turbojet exhausts had to be bent sharply down just after they left the engines.

Several short cuts are obvious in the test vehicle. Pilot is left in a simple open cockpit with no attempt to fair him into the fuselage. Fixed fuel tanks are slung under the wings simply because this is the easiest place to make room for them and yet keep their varying load centered at the plane's center of gravity. Fixed landing gear is used rather than the retracting gear that will be mandatory if this type of vehicle is to achieve its forward speed potential. The engine thrust can only be rotated partially rearwards: if it went fully horizontal it would burn up the underside of the fuselage.

Low Speed End

None of these expedients were considered detrimental to X-14 objective: further exploring the low speed end of a high speed VTOL aircraft.

The air jets for low speed control on the X-14 are practically identical with those tested on the first Bell VTOL. They use the same 15-45 lb. thrust force levels linked in with the corresponding aileron, rudder and elevator controls.

In the first VTOL it was found that the pilot could maintain control in hovering and vertical flight without artificial stability (sensing gyros hooked into an electronic compter) if he used rapid, "nervous" stick motions. Because the mass of the X-14 is greater than the first VTOL, it is relatively easier for the pilot to match his response frequencies with those of the aircraft.

Another advantage of the X-14 over the earlier design has been that the fixed engines in their horizontal position do not produce disturbing gyroscopic forces. The gyroscopic forces from the horizontally disposed Viper rotors in the X-14 produce only the customary yaw forces. In the first VTOL, during VTOL operations, the two J44 rotors were vertical and gyroscopic coupling produced a roll moment which was disconcerting to the pilot.

Bell did not disclose whether an auxiliary compressor was used to supply the airpower for the control jets or whether the control air was bled out of main engine compressors.

On the first VTOL a small Palouste turbocompressor was used as the source of control air.

Though the newer design keeps the engines close together, it is difficult

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if not impossible to maintain control in VTOL with one engine out, assuming that enough fuel were burned to permit the thrust of the single engine to support the plane.

Bell likes conventional attitude VTOLs because they are easier for the pilot to "zero in" on a small landing spot since they automatically weathercock into the wind and are not as susceptible to cross gusts as a tail sitter would be.

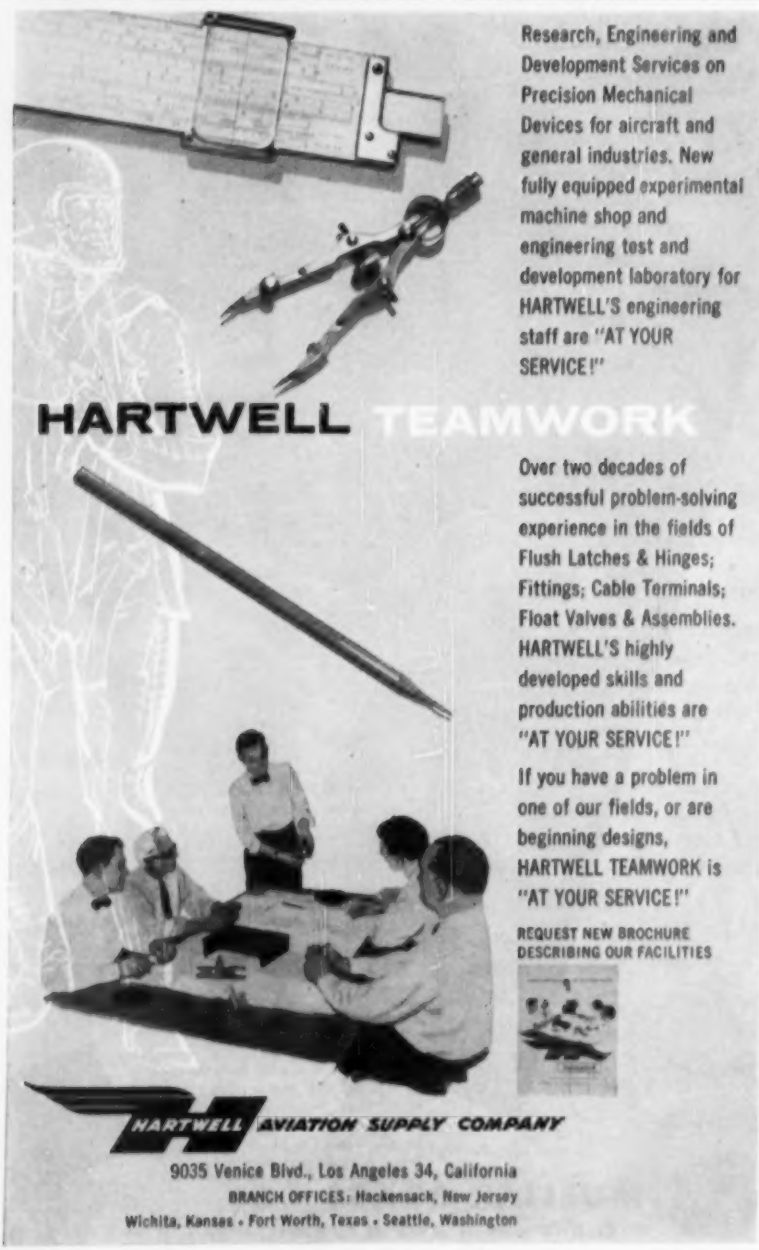
The Bell type is also easier to service without special rigs.

The Short SC.1 in Britain (AW Jan. 7, p. 30) is another test vehicle built around this principle. The Short Brother's Aircraft uses five Rolls-Royce engines of similar thrust but probably of much lighter weight.

Control is also with small jets located at airframe extremities (AW Jan. 7, p. 30).

VTOL take-off procedure at Bell has been to load the vehicle with fuel until it weighs as much as the combined engine vertical thrust, then to run the engines up and let the vehicle rise naturally as it burns off fuel. On the first VTOL, Bell limited rate of vertical ascent to 5 fps.

Dimensions of the X-14 are 34 ft. wing span by 25 ft. length and 8 ft. tail height.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Douglas Will Modify B-66s at Tulsa Plant

Program to modify more than 100 Douglas B-66 twin jet bombers under a contract awarded by the Air Force will help stabilize employment at the Douglas Tulsa, Okla., plant where the work will be carried out.

Employment at the plant, where the C-132 transport project was under way, is currently about 8,700 and the program will help to keep it at this level. The C-132 was one of the early victims of USAF fund tightening.

The B-66s will be flown from Tactical Air Command bases to Tulsa for inspection, repair and modification to latest combat configuration. The program will continue into 1959.

A B-47 IRAN program has been under way at the Tulsa plant for the last four years.

Civil Air Program Outlined for Britain

London—Government civil aircraft planning under the new economy program has been outlined by Minister of Supply Aubrey Jones.

Civil aircraft program must be stepped up to offset the cutback in Britain's military aircraft requirements, he said.

The minister expects that the Vickers VC.10, ordered by British Overseas Airways Corp., will enjoy large export sales. In addition, he indicated government support for these future British developments:

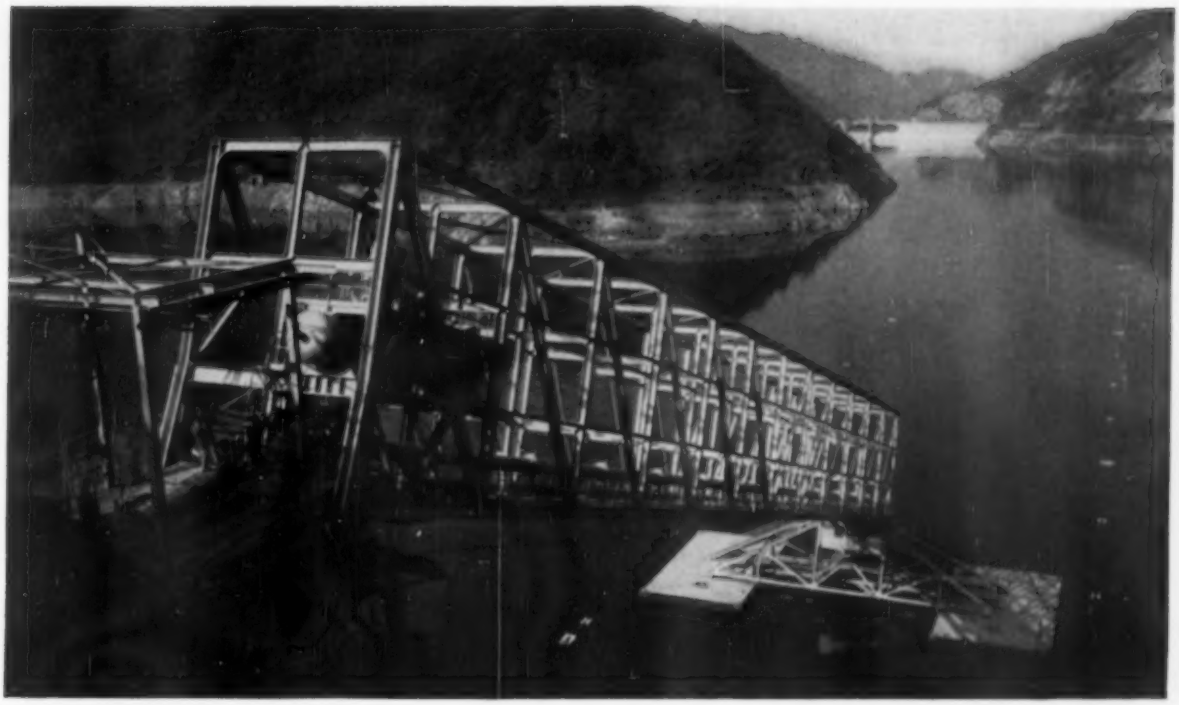
- **Medium-range jet** for British European Airways.
- **British supersonic airliner** which is considered a "must."
- **All British helicopter.**

"And in the field of smaller aircraft," the minister added, "we in Britain are well placed to supply the growing market for these throughout the world and particularly in the Commonwealth."

Military aircraft cutbacks were inevitable, he said, because too many military projects had expanded the industry to a level which could not be indefinitely sustained.

He urged the industry to increasing self-reliance, but suggested certain fields in which government help can be expected:

- **Fundamental research,** which he said, is beyond the scope of any individual company. There is no alternative to its being continued under government sponsorship.
- **Obligation** is recognized for the government to correlate its military demands for transport aircraft with the demand of BOAC and BEA for civil aircraft.



U.S. Navy Photo

The Variable Angle Launcher, one of NOTS' test facilities, is considered the largest "blow-gun" in the world. Experimental missiles are blown into the water through a 300-foot long launching tube.

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Established in 1943 by the Bureau of Ordnance, NOTS is the "home" of weapons such as the 2.75" MIGHTY MOUSE air-to-air rocket and the recently unveiled SIDEWINDER guided missile. These weapons are products of an effective military-civilian team at NOTS which originates and carries out weapon ideas; designing, developing, and testing guided missiles, rockets, torpedoes, armament-control systems, and other ordnance items until they are completed and ready for mass production.

Many specialized facilities enable the Station to pursue this broad program. Among these are highly instrumented test ranges, transonic and supersonic test tracks, facilities for the development and pilot production of solid and liquid propellants, a naval air unit equipped with planes of many types, a multimillion-dollar research and development laboratory, and other installations.

The main facility of NOTS encompasses over 1,200 square miles of the Mojave Desert 155 miles north of Los Angeles, while underwater ordnance activities are centered at Pasadena, with water test ranges located at Morris Dam, Long Beach, and San Clemente Island. About 4,800 scientists, engineers, and other civilians, and 1,200 military personnel at NOTS installations are constantly striving to develop better weapons for our nation's defense.

This is one of a series of ads on the technical activities of the Department of Defense.

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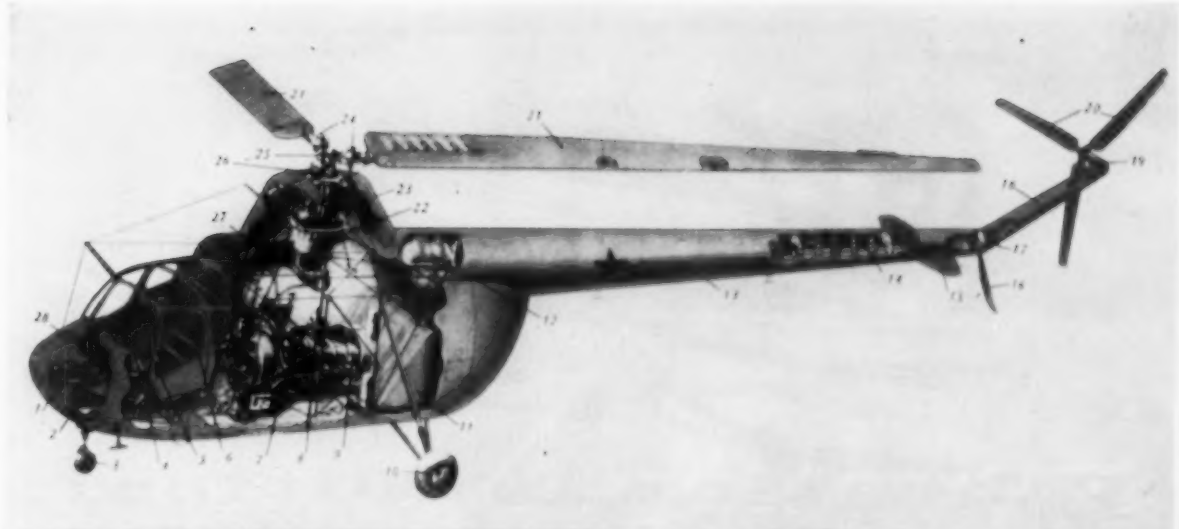


RUSSIAN DRAWING of Mil-1 is cutaway to show interior. The numbers indicate: 1—radio; 2—control stick; 3—nose wheel; 4—throttle and pitch control stick; 5—pilot's seat; 6—passenger divan; 7—engine; 8—main (vertical) shaft; 9—fan; 10—main landing gear wheel; 11—fuel tank; 12—tank for deicer fluid; 13—tail boom; 14—tail shaft; 15—stabilizer; 16—tail support; 17—tail reduction gear; 18—end boom; 19—rear reduction gear; 20—blades of steering (tail) rotor; 21—blades of lifting rotor; 22—fire-fighting cylinders; 23—main reduction gear; 24—dampers for blades of lifting rotor; 25—hub for lifting rotor; 26—automatic swash (wobble) plate; 27—oil tank; 28—levers for engaging clutch and for braking.

Russians Detail Mil-1 Flight Handling

Soviet aviation sources have expressed dissatisfaction with the small amount of literature available on piloting helicopters. To correct this deficiency, the magazine **Krylya Rodiny** *(Wings of the Fatherland) has begun a series of articles on flying the Mil-1 helicopter. The first, on ground handling, was written by G. Tinyakov, test pilot first class.*

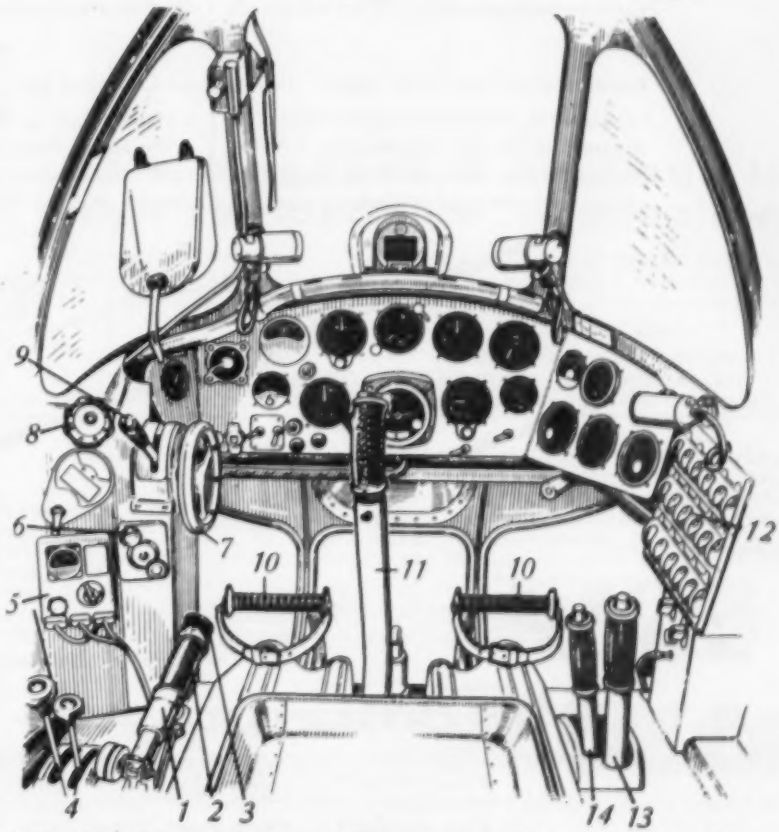
It has been translated by AVIATION WEEK *and is being reprinted in condensed form.*

Helicopters have recently been used ever more widely in our country. The helicopter encountered most often is the Mil-1. When equipped with dual controls, it is also used successfully for training flight personnel.

It is necessary to note that the Mil-1 helicopter has been modified several times. Thus, for example, the cabin dimensions have been changed; certain control levers have been transposed with various assemblies; a stabilizer with a variable adjusting angle has been installed; the oil system for the main reduction gear has been substantially modified; and so on.

INSTRUMENTS

The pilot's seat in the Mil-1 helicopter is located in the front part of the cabin. In this machine's passenger version a divan for the passengers is installed behind the pilot's seat. In



NUMBERS in diagram identifying cockpit layout are described in following by pilot.

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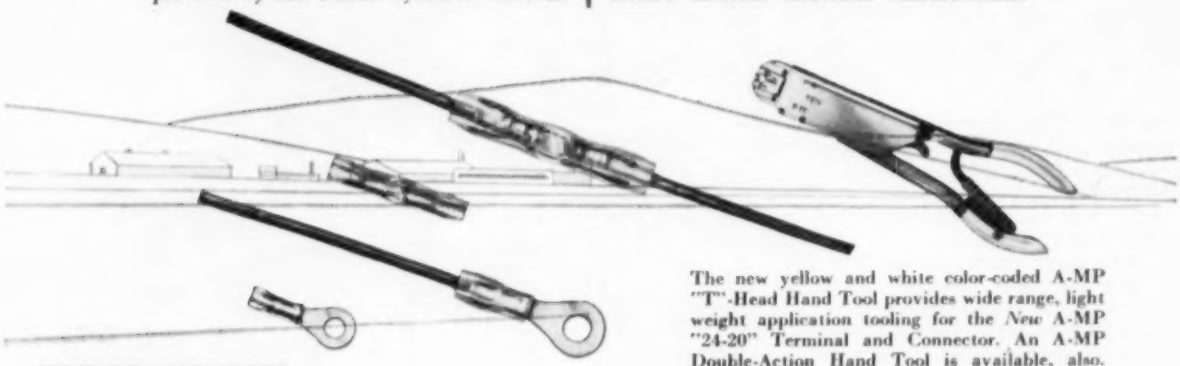

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the trainer version, the instructor's seat with a second set of controls is located behind and to the right of the pilot's seat.

At the left, alongside the pilot's seat, is a combined control stick for regulating the pitch of the lifting rotor and the engine gas feed—the so-called pitch-throttle (collective pitch) stick (Number 1 in cockpit drawing). With the combined control, the revolutions of the engine and of the lifting rotor remain practically constant at all regimes, speeds and altitudes of flight. Instances in flight of exceeding maximum engine revolutions and minimum revolutions for the lifting rotor are eliminated completely.

The collective pitch stick has a mechanical catch which allows the stick to be fixed securely in any position. This is convenient during long flights, when it is necessary to maintain a given engine operating regime. In this case the stick itself can be used as a support for the pilot's left hand.

On the upper end of the stick is a rotating throttle grip (2) which permits a reduced engine revolutions setting when the helicopter is flying on course, permits a takeoff revolutions setting during takeoff at a forced engine regime, and also permits maintenance of the required revolutions during flight at different altitudes.

The indicator on the catch knob (3) of the throttle grip revolves with the grip and enables the pilot to determine its turn not only visually but also by touch. This is especially convenient during night flights.

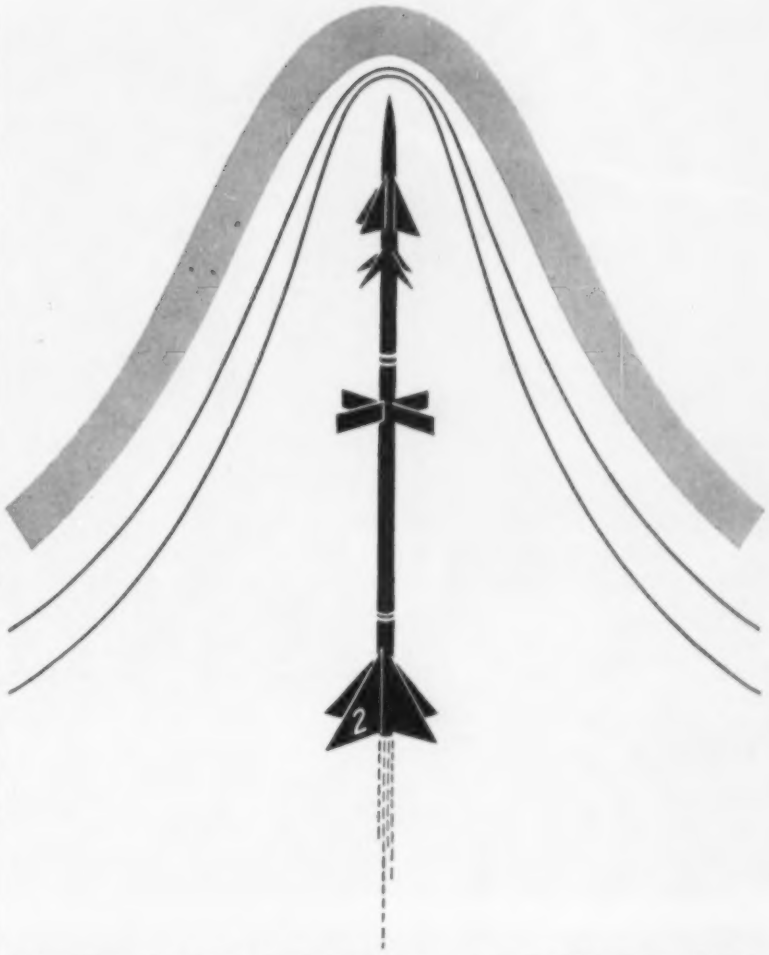
The combined control (collective pitch and throttle) stick is also connected with the helicopter's movable stabilizer which is installed to improve longitudinal stability.

Cockpit Layout

On the cabin floor, alongside the collective pitch and throttle stick, are the oil and fire cocks. The oil cock is used to prevent flooding the engine with oil, since the system is located above the engine. The cock is interlinked with the ignition system in such a way that starting the engine with a closed oil cock is impossible. The fire cock, as on an airplane, is necessary to stop the flow of fuel to the engine in case of fire and also while the craft is standing or undergoing repairs.

Alongside the cocks are two levers (4) for regulating the valves for cooling the engine cylinders and oil. To open them, the pilot should push on the knob of the lever (to release it) and then move it forward. The required temperatures for the cylinder heads and oil are maintained in accordance with the opening of the valves.

On the lower part of the cabin's left



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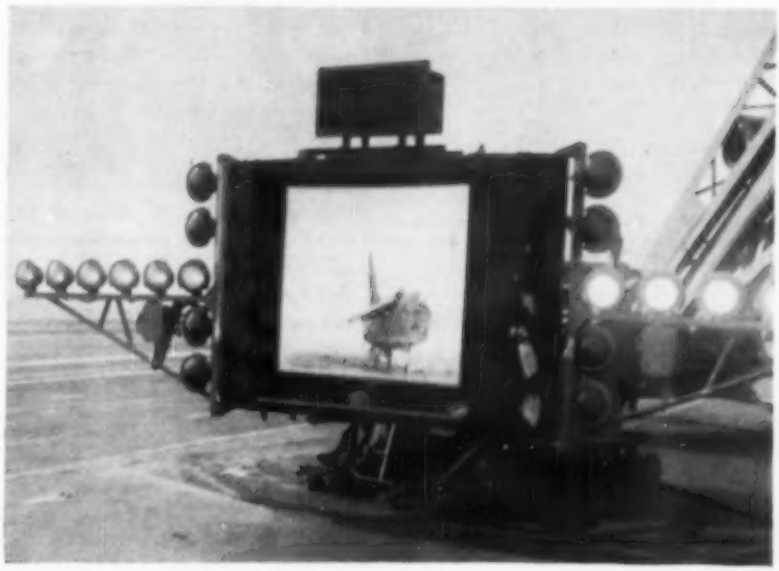
Navy Puts F8U Through Carrier Shakedown Trial

Carrier landing and takeoff techniques for the Chance Vought F8U-1 Crusader were developed aboard the Franklin D. Roosevelt by VX-3. Seven pilots and six Crusaders made 136 arrested and touch-and-go landings on the carrier's angled deck, using the mirror landing system (below and right).

Trailed by its shadow on the deck, one of the F8Us takes a wave off (left). Smoke streams from tailpipe as afterburner is cut in. Arresting hook from F8U (below) is engaging wire.

Glow from green lights on horizontal bar of mirror landing system (below, right) indicate a safe approach. Red lights on vertical rows flash to signal wave off.

Chance Vought recently received a $35 million Navy contract to continue development of successor F8U-3. Grumman F11F Tiger, also being qualified, is visible (center opposite).



panel are the control panels for the radio compass (5) and for the radio (6). In the upper part of the left panel are the control wheels for regulating the longitudinal (7) and lateral (8) "trimmers" and the altitude correction lever (9).

It should be kept in mind that the Mil-1 helicopter is not equipped with aerodynamic trimmers (stabilizers) like on most airplanes but with spring devices which provide a change in the forces on the control stick.

In the center section of the cabin, in front of the pilot's seat, there is an instrument panel, on the left-hand section of which are the generator switch, the voltmeter and the engine starting button. In the center section of the instrument panel are the flying and navigational instruments of conventional (airplane) type.

As differentiated from an airplane instrument panel, the manifold pressure indicator and the engine revolutions counter are included in the group of flying instruments. This is the result of the peculiarities of piloting (a helicopter) and also because of the possibility of using these instruments as auxiliaries (alternates) during blind flying.

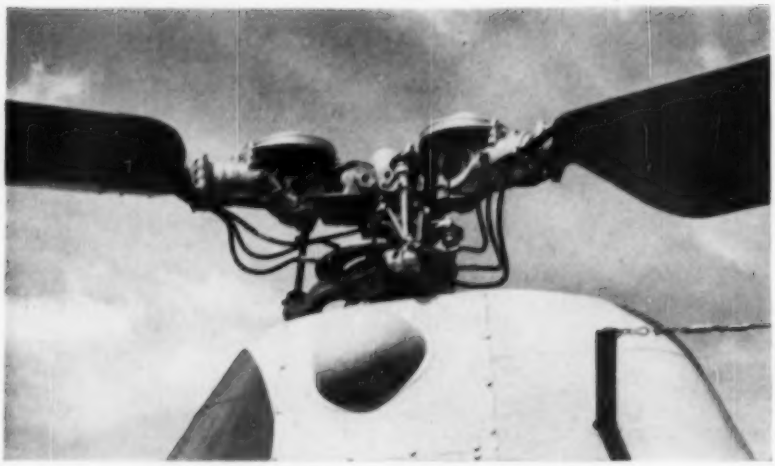
Two Needles

Despite the fact that the Mil-1 helicopter has only one engine, its revolutions counter has two needles. The needle with the letter M shows the engine revolutions, and the needle with the letter B shows the revolutions of the lifting rotor.

As is known, the revolutions of the lifting rotor are less than the corresponding revolutions for the helicopter's engine. If the revolutions for the engine and the lifting rotor always matched each other, it would be possible to get along with a single-needle revolutions counter. However, owing to the fact that there is an engaging clutch and a free-wheeling clutch in the transmission between the engine and the lifting rotor, the revolutions of the engine and of the lifting rotor sometimes vary greatly.

When gliding in an autorotation regime, especially during training or practice, it is very important for the pilot to know whether the engine revolutions match the revolutions of the lifting rotor. In the past, when the helicopter's instrument panel had two indicators with different markings, it was very difficult to determine the beginning of the lifting rotor's autorotation. The two-needle revolutions counter, which only has markings for engine revolutions, considerably eases the task of checking on normal operation of the engine and the lifting rotor both on the ground and in flight.

Below, under the instrument panel,



Polish Helicopter Hub Details

Rotor Hub for Polish SM-1 helicopter shows design details of the three-blade layout. Lines for liquid deicing installation run from collector above pitch control to blade leading edges. Joint between blade and hub is a two-bolt connection with a pair of mating grooved machined parts. Helicopter is available for export, is basically the Russian-designed Mil-1, code-named Hare by the NATO system. Quoted price for this model, demonstrated at the 22nd International Aeronautical Salon at Le Bourget, was $55,000.

there are pedals (10) for controlling the steering rotor or, as it is still called, the tail rotor.

During straight-line flight in an airplane the pedals are always kept in neutral. In a helicopter the position of the pedals changes, depending on the regime and speed of flight. In hovering the helicopter the right pedal is moved forward; in flying on course at cruising speed the pedals are almost in neutral position, and, finally, in gliding with the lifting rotor in autorotation regime, the left pedal is pushed forward more than half way.

Pitch Control

Between the instrument panel and the pilot's seat there is a stick (11) for controlling the cyclic pitch of the lifting rotor. On the cabin's right panel there are automatic devices, shields and switches for the various instruments of the special equipment (12).

Near the right-hand panel, on the floor, are two levers. One controls the clutch for engaging the transmission (13), the second the transmission braking (14). Before starting, the levers must be pulled back as far as possible, the clutch is disengaged, and the transmission is braked. These levers have reciprocal locking. Without first having released the transmission brake it is impossible to engage the clutch and, with an engaged clutch it is impossible to brake the transmission.

The engine starting unit is on the right side of the pilot's seat.

Before starting the engine, the helicopter must be securely tied down with special mooring ropes to metal rings fastened in the ground. It is also necessary to be sure that for a distance of 5-6 ft. around the helicopter there are no light objects (covers, boxes, pails, etc.) which can be raised by the air stream from the lifting rotor and can damage its blades. All the blades of the lifting rotor must be placed on the forward support.

Having first made sure that the clutch engaging and transmission braking levers are in back position, it is necessary to check whether the fire and oil cocks are open and whether the collective pitch stick is let down. Then the throttle adjustment grip is set in the middle position of low throttle and priming of the engine is accomplished by a starting pump. Having given the command "contact," the pilot opens the starting cock and then presses the starting button.

Having made sure that the oil pressure is normal (no less than 45-100 psi.) and having given the engine an opportunity to operate for several seconds at low revolutions (800-1000 rpm.), it is then necessary to increase the engine revolutions to 1250-1400 per minute by precise turning of the throttle adjustment grip. When the oil temperature is no less than 40C and the cylinder head temperature is 80-100C, unwinding (engaging) of the transmission can be started. To do this, after first having released the transmission brake, it is necessary to grasp the clutch engaging lever, unlock it, and then with an even movement shift it to the first detent, keeping it in this position.

After releasing the transmission

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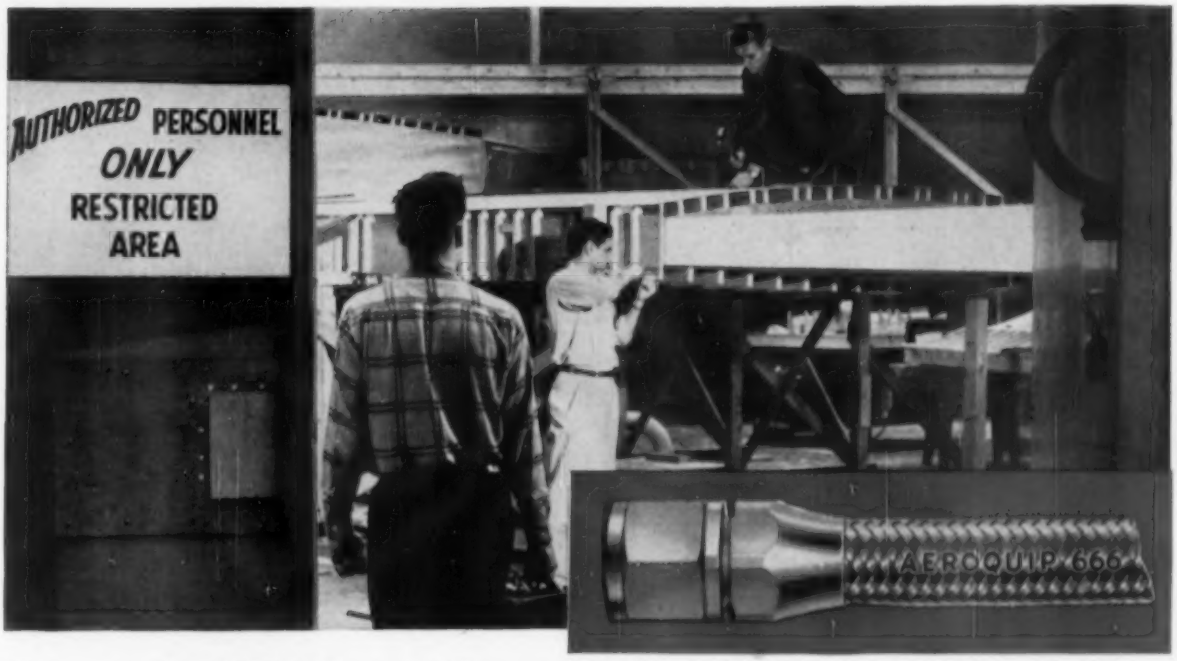

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brake, the helicopter's lifting rotor will begin to turn slowly. After shifting the clutch lever the lifting rotor will begin to increase its revolutions noticeably. The needle with the letter B on the revolutions counter will leave the zero position and will show that the revolutions of the lifting rotor are increasing. Simultaneously the helicopter shows a slight tendency to turn left. It is not advisable to counteract this tendency of the helicopter since the effectiveness of the steering (tail) rotor is very small owing to its small number of revolutions.

Matching Rpm.

After waiting several seconds until there is a matching of the needles on the revolutions counter and after pressing once more on the catch of the clutch engaging lever, it is necessary to advance it to the detent.

When the clutch lever was moved approximately half way, only the friction part of the clutch was engaged. The mutual slippage of the leading and following parts of the friction clutch permits the transmission and the lifting rotor to unwind evenly. However, the friction part of the engaging clutch doesn't ensure a reliable connection of the engine with the transmission. Therefore, with further shifting of the clutch lever, a cam section, which securely connects the engine with the transmission, is engaged.

After engaging the clutch, it is necessary to check the oil pressure and temperature in the main reduction gear. If the pressure is 30-70 psi. and the temperature is 35-95C, then the engine can be tested. Before this, it is once more necessary to be sure that the helicopter is securely tied down.

Grasping the collective pitch stick with the left hand and the helicopter control stick with the right hand, the pilot may now start testing the engine. To do this, holding the control stick in neutral position, the pilot should turn the throttle adjustment grip to the middle position. Then, having pressed on the catch device, he should start moving the collective pitch stick upward, toward himself, with a steady motion. The direction of the pilot's glance must be such that he sees the engine control instruments and also observe simultaneously the area in front of the helicopter.

While in the process of opening the throttle and raising the engine revolutions, one should check on the amount and smoothness of their increase by means of the revolutions counter and check on the manifold pressure by means of the pressure feed indicator. The evenness of the engine's operation can be checked by ear. When the revolutions reach 2050 per minute and the manifold pressure reaches 30 in., one should, after having released the catch, fix the collective pitch stick in this position and check the readings of all the engine instruments. Even before reaching rated engine capacity, the helicopter lifts itself off the ground and stretches the mooring ropes.

Wind Expect

With a strong but not particularly gusty wind, the engine testing is accompanied by sharp jerks and pulls on the part of the helicopter. If it is planned to use a forced operating regime during flight, then after testing the engine at rated power the collective

RUSSIAN Mil-1 helicopter is utilized by Soviet aerial medical service, along with AN-2 and Yak-12 aircraft. Effectiveness of steering (tail) rotor of the three-bladed Mil-1 is offset somewhat owing to its fairly low rpm.

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pitch stick should be shifted farther upward so as to obtain a manifold pressure of 35 in. and revolutions of 2200 per minute.

Taxiing is accomplished by pitching (in the appropriate direction) the lifting force of the lifting rotor—making left turns with the help of the reactive moment of the lifting rotor and right turns by increasing the thrust of the steering (tail) rotor.

A sufficiently-large horizontal component of the lifting force of the lifting rotor is required to move a helicopter along the ground. This can be achieved with a large pitch of the automatic swash (wobble) plate or by a large amount of lifting force from the lifting rotor. Each of these methods is disadvantageous by itself. A large pitch of the automatic swash plate is undesirable because there is a possibility of hitting the blades against the lower supports of the hub. The second method also won't do by itself.

It follows from this that the lifting power of the lifting rotor must, during taxiing, have a magnitude which is ensured by retention of a certain number of engine revolutions.

Taxi Characteristics

In calm weather, it is recommended that taxiing on fairly hard ground be done in the following manner. First turn the throttle adjustment grip to its middle position (if it had been retracted after testing the engine). Then it is necessary to increase the engine revolutions to 1700-1750 per minute by moving the collective pitch stick upward while simultaneously keeping the helicopter from turning left with the pedals. After achieving the specified revolutions, the collective pitch stick should be fixed and the helicopter's (cyclic pitch) control stick should be moved away from the pilot about half the full distance.

Keeping the (cyclic pitch) control stick in this position, the pilot should observe attentively the helicopter's initial forward movement. The pilot moves the (cyclic pitch) control stick gradually toward him to the degree that the taxiing speed increases. With a steady taxiing speed, the cyclic pitch control stick must be in a middle position between neutral and the deflected position prevailing at the moment when the helicopter starts moving.

During taxiing along a concrete runway, the speed must not exceed 10 mph. In taxiing over hard ground with little grass cover, the speed should not be above 5 mph. The requisite speed is maintained by the appropriate degree of deflection of the cyclic pitch control stick.

Taxiing over soft ground has its own special characteristics. Thus, for example, after setting the requisite engine

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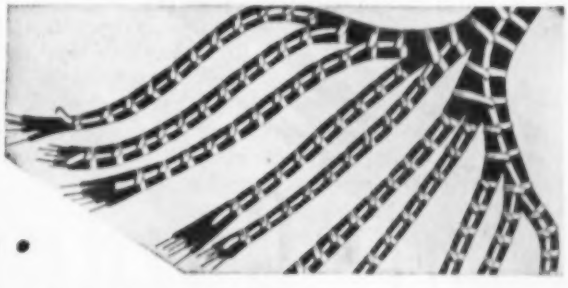

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revolutions and the appropirate inclination (deflection) of the cyclic pitch control stick, the helicopter very frequently remains on the spot. The engine revolutions should not be increased. In this case it is necessary to enable the helicopter's wheels to roll out of the hole that has been formed by alternate movement of the foot control pedals, carefully swinging the craft left and right.

Rough Ground

Taxiing on very sticky, rough ground (mud, plowed land, deep snow, high grass, etc.) is forbidden. In such cases, movement within the boundaries of the area are carried out by flying at low altitude (6-16 ft.). Attempts to taxi on sticky, rough ground at the recommended engine revolutions end in failure.

Some pilots, in trying to force the helicopter to move by raising the collective pitch stick, increase the horizontal component of the lifting force of the lifting rotor. The increasing lift decreases the pressure of the wheels against the ground. The helicopter begins to move forward. Whereupon, owing to the increase in the reactive moment of the lifting rotor, the thrust of the steering (tail) rotor also increases greatly because the pilot, in countering the helicopter's tendency to turn left, pushes the right pedal of the foot control forward.

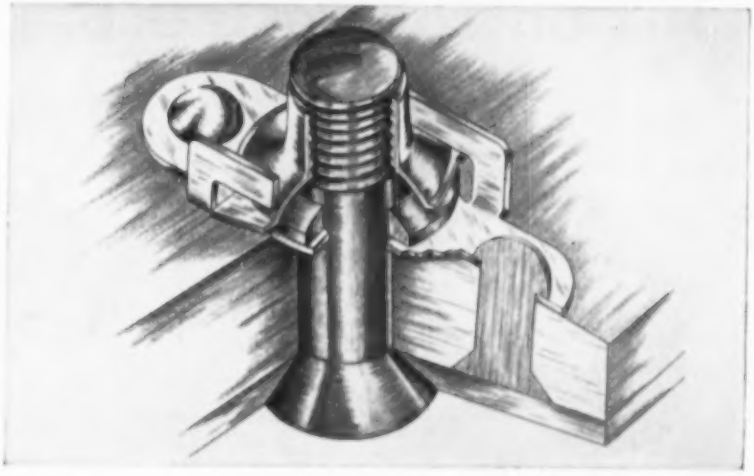
The increased thrust of the steering (tail) rotor, along with decreased wheel pressure against the ground moves the helicopter to the left at the same time that it goes forward. Whereupon a small bank of earth is formed in the ground on the outside of the left wheel of the landing gear. This bank prevents the helicopter from going to the left. Then, under the influence of the steering (tail) rotor's heeling moment, the helicopter will begin to heel to the left. Attempts to counteract this heeling by inclining the control stick to the side cannot rectify the situation. The helicopter, having turned over, has suffered an accident.

When the helicopter tries to heel to the left, it is necessary by quick action to shift the collective pitch and throttle stick to a lower position, at the same time pushing forward (no less than half way) the left pedal of the foot control.

With the lowering of the collective pitch and throttle stick, the lifting force and the reactive moment of the lifting rotor decrease sharply. However, the revolutions of the lifting and steering (tail) rotors will decrease slowly. Therefore, in pushing the left pedal forward, the thrust of the steering rotor tilting the helicopter to the left is decreased.

If the heeling is noticed too late, it is advisable to lift the helicopter off the

FASTENER PROBLEM

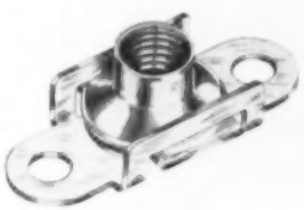


Lightweight floating anchor nut for bolting non-parallel surfaces

THE PROBLEM: Using large single forgings for aircraft bulkheads, wing center sections, spars and ribs offers manufacturers many advantages. It simplifies design and reduces milling costs, and it provides greater strength while reducing air frame weight. However, this type of construction also creates fastening problems. For example, attaching skins and components to these tapered forgings is difficult because the bolt head and seating surfaces are not parallel. Two methods are frequently used to make the fastening areas parallel. They are: 1) spot face machine the seating surfaces, 2) build up each bolt head or nut base with tapered shims. Because there are often hundreds of fastening points, both of these methods are excessively costly and time consuming.

THE SOLUTION: ESNA's redesigned lightweight self-locking anchor nut (Type LHA3022) solves this fastener problem, eliminates these costly, shimming and machining operations and significantly steps up production.

Type LHA3022 consists of a steel nut body with a concave spherical base. The convex seat permits the nut to move automatically with a ball joint action to engage the bolt threads. Two lugs retain the nut in the basket and control the "tilt" to 8° in any direction.



Type LHA3022 is made of carbon steel for use at temperatures up to 550° F. It meets AN-N-10 performance and MIL-N-25027 (ASG) twist- and push-out specifications. Like all Elastic Stop® nuts, it is vibration proof and reusable.

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ground by quickly increasing the pitch of the lifting rotor and opening the throttle. In this way the support under the left wheel is removed and, consequently, the possibility of turning over is eliminated.

A strong, gusty wind also complicates taxiing even on hard ground. In this case turn the throttle adjustment grip to bring the engine revolutions to 1,750-1,800 per minute, increasing the total by no more than 60.

It is necessary to remember something else about one dangerous phenomenon which is encountered in taxiing—the so-called "ground resonance." This phenomenon takes place in roughly the following sequence: at first the helicopter begins to swing from side to side on the uneven ground. Then these oscillations grow to such a magnitude that the landing gear wheels, alternately lifting up, strike against the ground. The magnitude of the tilting keeps increasing. Whereupon, the helicopter may not only break its landing gear or brush the blades of the lifting rotor against the ground, but might also turn over.

Efforts to counteract the helicopter's oscillations by inclining the control stick are useless. It is possible to stop the "ground resonance" by thrusting the collective pitch stick sharply downward or by quickly pulling it upward in order to lift the helicopter off the ground. The first alternative is the most sensible. In this case the helicopter gets back firmly on its wheels and remains on the ground.

"Ground resonance" can develop under several conditions: at a certain taxiing speed in conjunction with unevenness of the ground; with insufficient—below normal—tightening of the friction dampers of the lifting rotor's blades; with soft shock absorbing in the helicopter's landing gear, or through lifting rotor revolutions which correspond to the resonance conditions.

The resonance effect may be observed with each unwinding of the transmission. It is true that it also takes place at intermediate revolutions to a very small extent.

Taxi Stops

To stop a helicopter at the place contemplated, it is necessary for the pilot, without changing the position of the collective pitch and throttle stick, to pull the control stick toward him no less than half the full distance from neutral position. The stick should not be inclined a great amount, since in such case the helicopter may fall at the tail and touch the ground with the tail support, which is undesirable.

After the pilot pulls the control stick toward him, the helicopter noticeably reduces its speed of movement, since the horizontal component of the lifting rotor's lift force, having now been moved to the rear, will brake the ship. The pilot should start early to brake for a stop at a planned point.

As soon as the helicopter stops, it is necessary to shift the control stick into neutral position. If the control stick should remain in an inclined position, the helicopter will begin to move backward—tail first. This characteristic frequently is used, for example, when a precise stop in a small area is required, particularly after unsuccessful taxiing.

Many pilots at first make a typical error which, in certain cases, can lead to an accident. Having unexpectedly encountered an obstacle in the path of the taxiing helicopter, and in trying to stop quickly, the pilot suddenly cuts the throttle and, consequently, the engine revolutions. As a result, if the taxiing is being done on a concrete runway, the uncontrolled helicopter, moving by inertia, may collide with the obstacle. The pilot in this case not only is unable to stop the helicopter but also is unable to turn it because of insufficient effectiveness of foot control.

To ensure good control of the helicopter during taxiing it is always necessary to maintain the recommended engine revolutions. In such case the helicopter can easily be stopped before reaching any obstacle.

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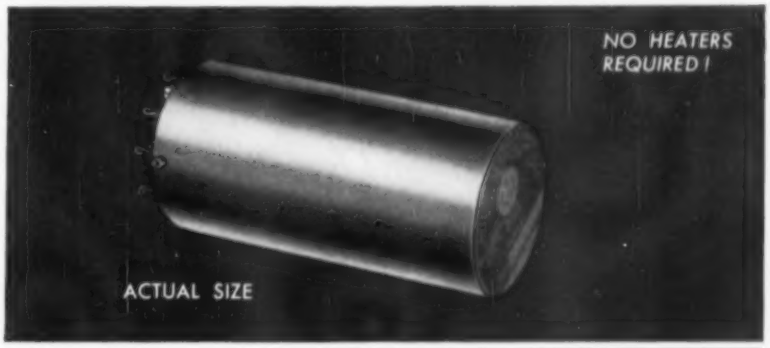

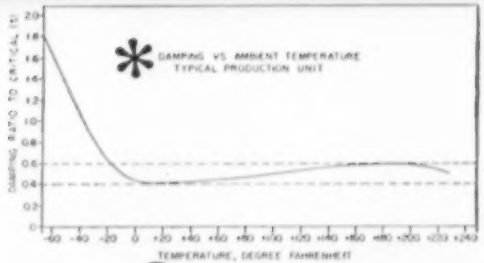

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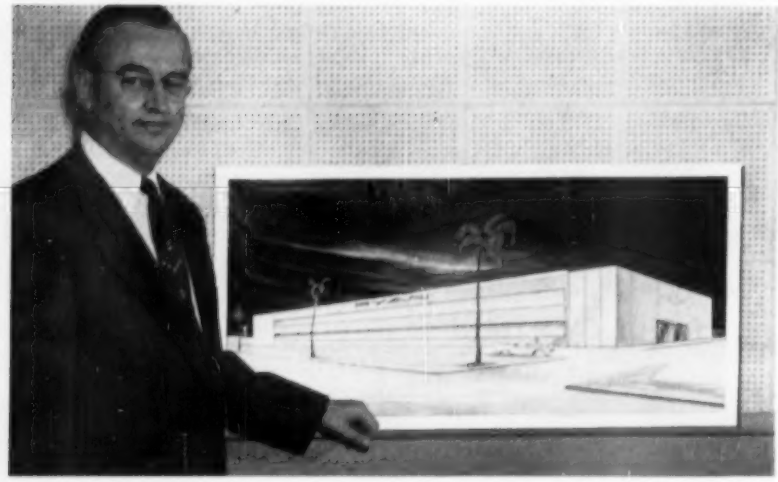

FRANK W. FINK, RYAN VICE PRESIDENT AND CHIEF ENGINEER inspects architect's drawing of new Engineering and Research Center.

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Construction of a modern two-story, engineering and laboratories building has begun at Ryan, to meet the company's expanding work in Jet VTOL—Automatic Navigation—Jet Drones—Missile Guidance—Jet Metallurgy—Rockets.

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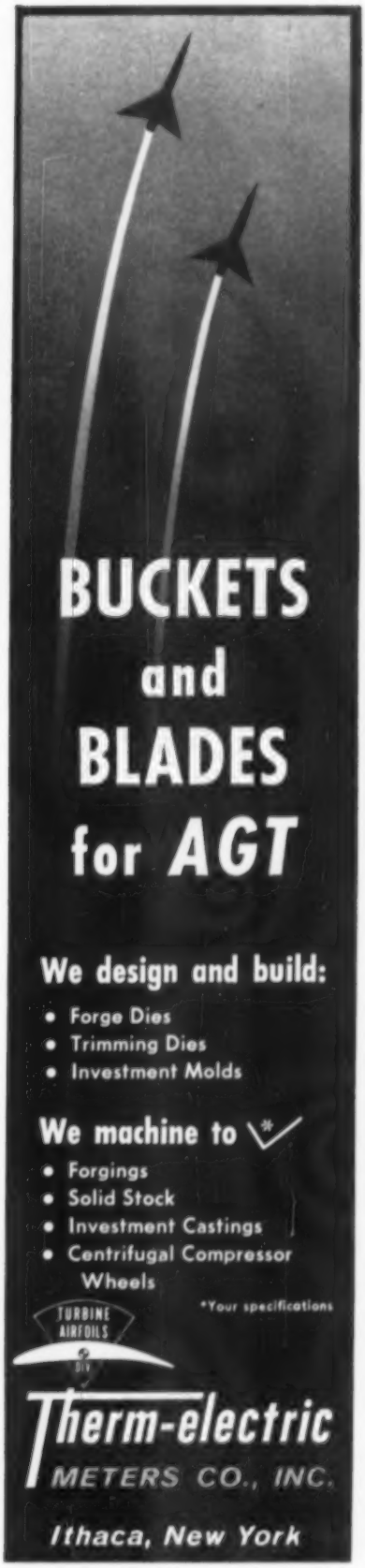
Brantly May Get Army Contract

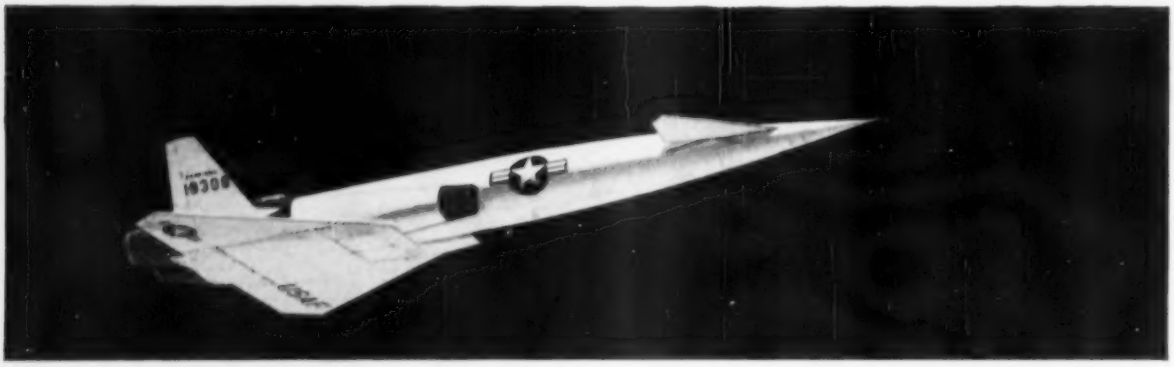
Army contract for Brantly helicopters is expected to be awarded soon. Shown is latest version of two prototypes, incorporating several modifications: tail is now angled upwards to protect 4 ft. 3 in. tail rotor from ground contact; tips of 23 ft. 8 in. diameter main rotor are now tapered (they were square before); inboard portions of blades have been revised from tubular to airfoil shape. Powered by 170-hp. Lycoming, two-place Brantly has 100-mph. cruise speed, climbs at 1,300 fpm.



Engineers: This coupon means action!

Success of X-10 Test Missile program steps up systems engineering work on

Intercontinental SM-64 Navaho



The pace is quickening, as we gather forces for the climactic effort on the Navaho. If you like excitement in your engineering—this is it! You can decide now, and still get in on the work coming up at North American's Missile Development Division. It's going to be an assignment you'll be glad you took part in for years ahead.

James A. Trapp, 33, has been with NAA's Missile Division since 1952. He holds both BS and MS in Electrical Engineering. Now Group Leader, Auto Checkout Systems, he supervises development of digital techniques. Hi-fi fan and fisherman, this Oklahoman now lives in Long Beach with his wife and 2 California tots.

The Navaho is a project with the toughest kind of painstaking engineering behind it. It's been several years now since this organization set out to deliver to the Air Force a complete strategic weapon system. On the way we opened up and proved out more workable missile information than any other source: structures, guidance, propulsion, armament, ground handling, launching—the works. Now you can join us . . . get in at the forefront of missile technology. If you do, you're going to build a weapon with the world's most advanced self-contained guidance system . . . driven at supersonic speeds by both rocket and ram-jet engines . . . and packing an accuracy/payload punch that's unbeatable in the foreseeable future.

Charles H. ("Chuck") Lauritsen, 31-year old ex-Navy man, hails originally from Beatrice, Neb. Study at Chicago, Northwestern and Michigan gave him his BS and MS, Aero Eng. Starting in 1947, he rose thru Group Leader to Section Head of Project Aerodynamics, responsible for aerodynamic analysis on all Division contracts.

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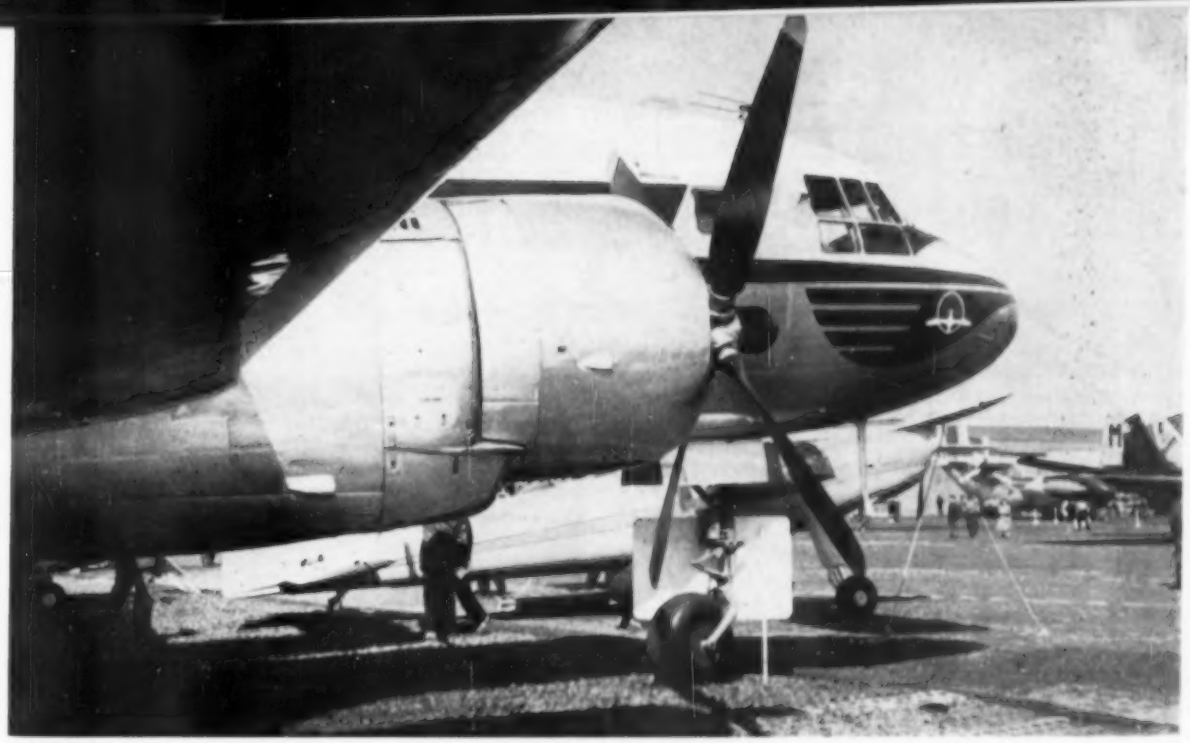


CZECHS BILL the Avia 14 as a direct successor to the DC-3. Note cockpit windows, which make for good side visibility.

Czech Avia 14 Stresses Short Field Use

By David A. Anderton

Paris—Short field performance is the strong selling point for the Avia 14, designated by its Czech manufacturer as a development of the Russian Ilyushin 14 airliner.

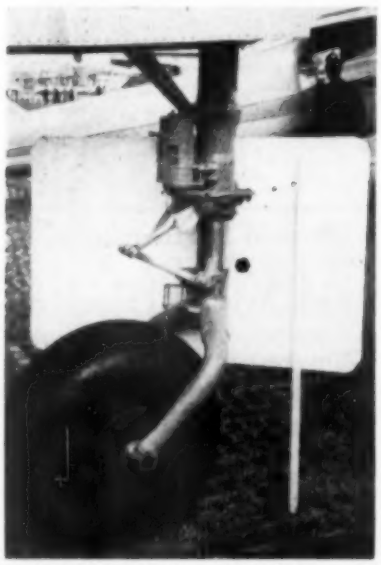
Takeoff and landing figures quoted are less than 2,000 ft. on grass or unimproved fields.

Timed takeoff runs made during the 22nd International Aeronautical Salon at Le Bourget were all close to the 15 sec. mark, approximately two-thirds of the usual figure for comparable equipment.

Billed as a direct successor to the Douglas DC-3 by the Czechs, the Avia 14 was shown at Le Bourget in a 22-seat version, different in layout from the four interiors offered in the sales brochure.

Standard layouts are for 24, 28 and 32 passengers and a 12-place executive version can be had.

Cabin decor in the plane at Le Bourget was in salmon and brown, and the seats were comfortable and wide-spaced. A fairly large galley is part of the standard equipment. Cabin is not



NOSE GEAR (left) has welded fork assembly. **Main gear** (center) is simple layout of welded components plus few machined parts. **Recessed cowling flaps** (right) are sealed with rubber strip at trailing edge for cruiser operations, minimizing drag.

Class of '56...OR THEREABOUTS?

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ANTENNA on forward fuselage belly is typical of strake types used on Russian Tupolev Tu-104. Forward cap is metal, rest is dielectric material.

pressurized but is ventilated and heated in the usual way.

Powerplants are a pair of M 82-T 14-cylinder direct-injection radial engines rated at 1,900 hp. each for takeoff. These are presumably identical to the ASh-82 engines used in the Ilyushin 14. They swing four-bladed AV 50 propellers.

Hot-air deicing is used for wing and tail leading edges, cockpit windows and antenna mounts. The cockpit windows are also heated electrically and fitted with alcohol sprays. Alcohol is also used to deice the propellers. Windshield wipers are hydraulically operated.

Price: $350,000

Prices quoted for the 24- and 28-passenger version are approximately $350,000 each. The 22-place version is only being built for internal service.

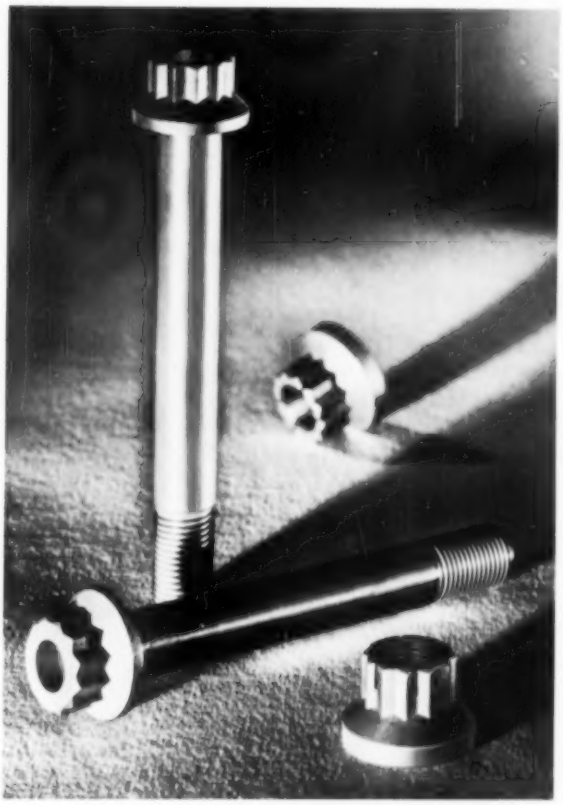
The delivery dates quoted vary with the model. Ten planes could be furnished to a prospective customer this year, with unlimited delivery of the 24- and 28-passenger versions in 1958. The 32-seat version will become available at the end of July 1958.

Quoted Performance Data for Czech Avia 14 Transport

Maximum speed	259 mph.
Cruise speed	199 mph.
Minimum speed	68.5 mph.
Time to climb to 3,280 ft.	3.2 minutes
Service ceiling	22,000 ft.
Range	1,245 mi.
Takeoff distance	1,475 ft.
Landing distance	1,805 ft.
Weight Data	
Empty weight	27,200 lb.
Maximum takeoff weight	38,200 lb.
Useful load	10,800 lb.

New SPS High-Temperature Fasteners Have 170,000 psi Tensile Strength at 900°F

Hi Tm 9 bolt and nut developed by SPS research help solve Mach 3-4 fastening problems



NEW EWB Tm 9 BOLT is made of a hot work die steel (VascoJet 1000); has 220,000 psi tensile at room temperature, 170,000 psi at 900°F. Companion Flexloc locknut—EWN Tm 9—is made of AMS 6304 material; has ample strength to utilize the full tensile values of the bolt at all temperatures up to 900°F.

In response to the aircraft industry's request for a fastener with high strength and stability at Mach 3-4 skin temperatures, SPS has developed a 12-point external wrenching bolt with 170,000 psi minimum tensile at 900°F. Classified as EWB Tm 9, this remarkable new bolt—made of a 5% chrome die steel—is actually stronger at 900°F than most other high-strength bolts at room temperature. And it retains its high tensile strength even after long exposure to heat. Other properties, such as shear, fatigue and stress rupture, are also superior—both at room and elevated temperatures.

To match the EWB Tm 9 bolt, SPS has produced a new external wrenching Flexloc self-locking nut—EWN Tm 9. Made of AMS 6304, it utilizes the full mechanical properties of the EWB Tm 9 bolt at all temperatures up to 900°F. Both units—bolt and locknut—are finished in a diffused cadmium-nickel plate that resists the accelerated oxidation effects of high temperatures and corrosion at room temperature.

With their high strength-to-weight ratio and ability to withstand the deteriorating effects of heat, the EWB Tm 9 bolt and companion locknut give the designer an important new tool with which to solve the fastening problems presented by high-speed, high-temperature flight. Hi Tm 9 fasteners are available as 12-point external wrenching tension bolts and locknuts in diameters from ¼ to 1½ in. The same material and processing procedures can also be applied to shear bolts and other special applications. SPS Aircraft Products Division engineers are ready to work with you in applying these new fasteners to your specific high-temperature problems.

MIN. TENSILE STRENGTH OF EWB Tm 9 VS. STAINLESS AND ALLOY STEEL BOLTS

	At Room Temp. (F)	At 800°F	At 900°F
EWB Tm 9 (VascoJet 1000)	220,000	190,000	170,000
AMS 5616 (stainless steel)	145,000	105,000	95-100,000
AMS 6304 (alloy steel)	145,000	123,000	110-120,000

EWB Tm 9 BOLT has 50-70% greater tensile strength at 900°F than stainless and alloy steel fasteners currently used at this temperature. Above data are for *bolts*, not material specimens.

MECHANICAL PROPERTIES OF THE EWB Tm 9 BOLT

Properties	At Room Temp. (F)	Room Temp. After 100 Hr. Soak at 900°F	At 900°F
Ultimate tensile, psi minimum	220,000	220,000	170,000
Yield strength, psi minimum	185,000	185,000	140,000
Elongation in 4 diam., % minimum (specimen)	10	10	16
Reduction of area, % minimum (specimen)	35	35	50
Shear strength, psi minimum	140,000	140,000	100,000
Stress rupture, psi for 100 hr. life	.....	.....	130,000
Fatigue strength, psi /8,000,000c/10% preload	80,000	60,000	80,000
Impact strength, ft.-lb. (Charpy)	18	18	23

AT 900°F THE EWB Tm 9 BOLT offers mechanical properties exceeding those of an MS 20004 Series bolt at room temperature. Equally significant in this thermal barrier breakthrough, it retains superior properties even after long exposure to high temperatures.

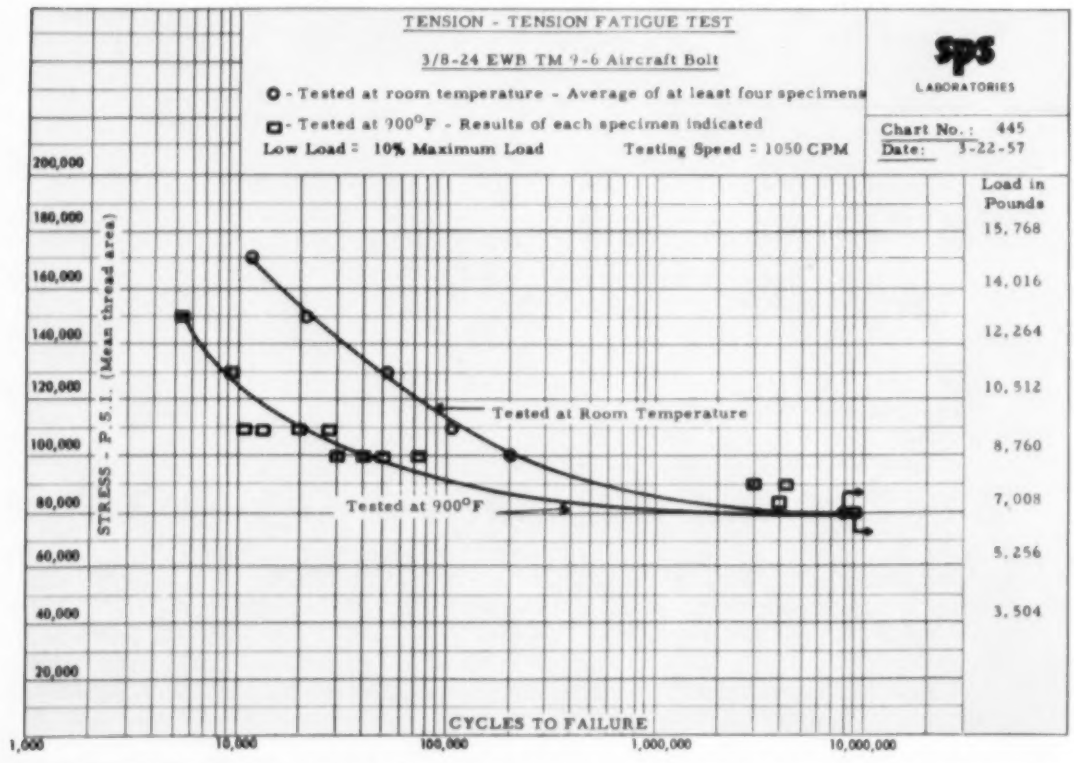
BREAKING THE TEMPERATURE BARRIER. An EWB Tm 9 bolt is positioned for testing on a tensile machine equipped with a furnace that is accurate within ±2°F up to 2000°F. At-temperature research data on the EWB Tm 9 are the most extensive ever assembled for a production fastener. They include the first fatigue and shear compilations for bolts under heat.

Hardware for High-Speed Airframes

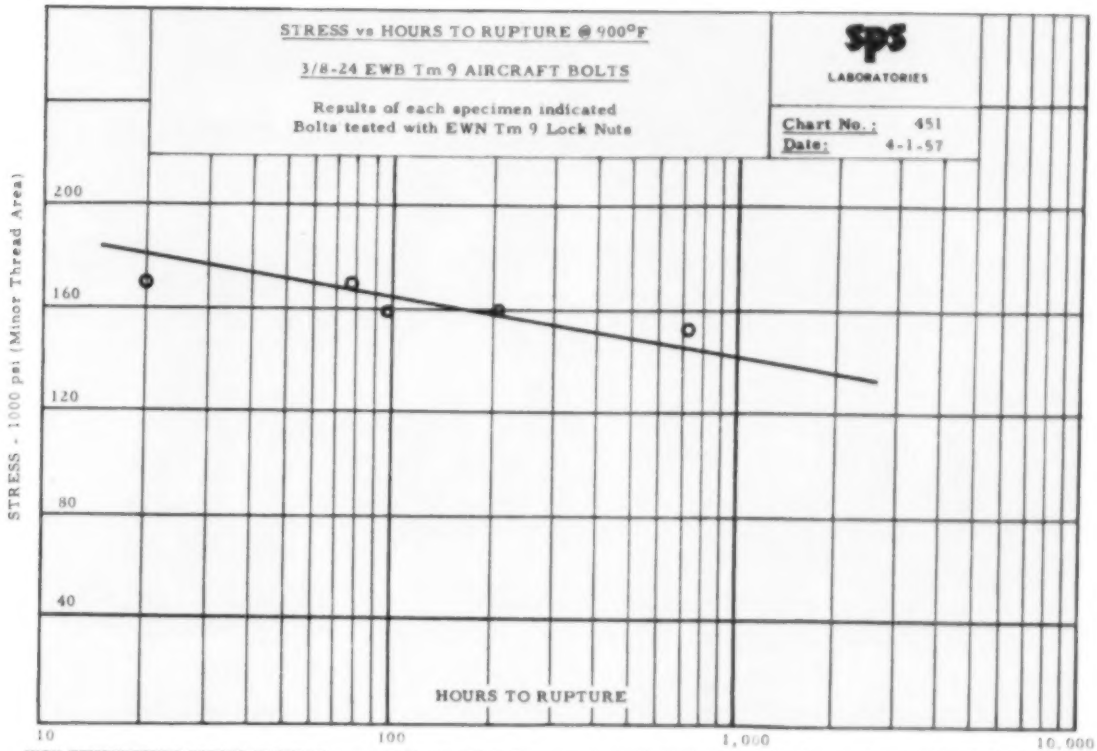
The SPS crash program on a new high-strength, high-temperature fastener began late in 1955 following the aircraft industry's demand for hardware for 800°F skin temperature. A year later the first EWB Tm 9 bolt was produced. This was possible because of SPS's extensive research and test facilities built up over the years, and the largest in the industry.

With high-strength fastener fabrication techniques well in hand after development of the EWB 18 bolt (180,000 psi) and the EWB 22 bolt (220,000 psi), the biggest problem was to find an alloy of the desired mechanical properties at elevated temperatures. Many materials were subjected to exhaustive testing. Finally VascoJet 1000, a 5% chromium hot work die steel made by Vanadium-Alloys Steel Co., was chosen. Its stability and strength at high temperatures largely determined selection of it.

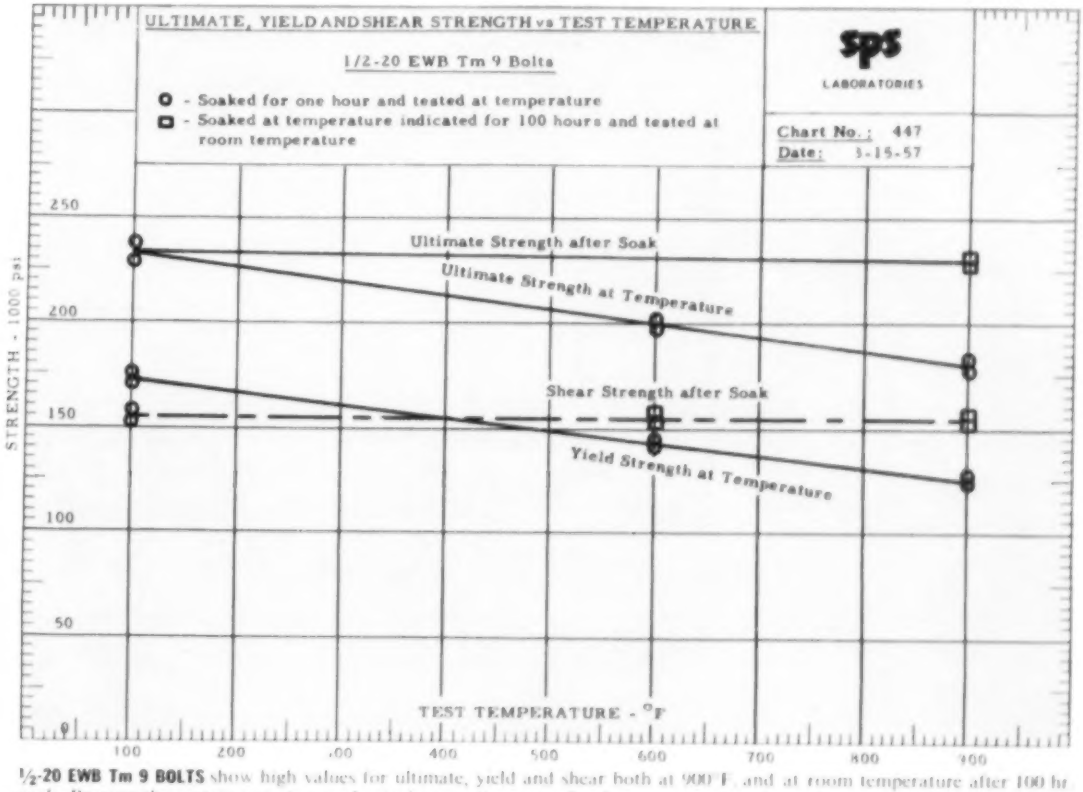
The other major problem was plating. Cadmium melts at just above 600°F and diffuses into the bolt metal, causing embrittlement. Research turned up an existing plating technique—AMS 2416—that proved to be the solution. This finish is applied as separate layers of cadmium and nickel. After plating, the parts are heated to 630°F, at which temperature the two metals diffuse into an alloy that successfully resists the aggravated oxidation and corrosion caused by high temperatures.



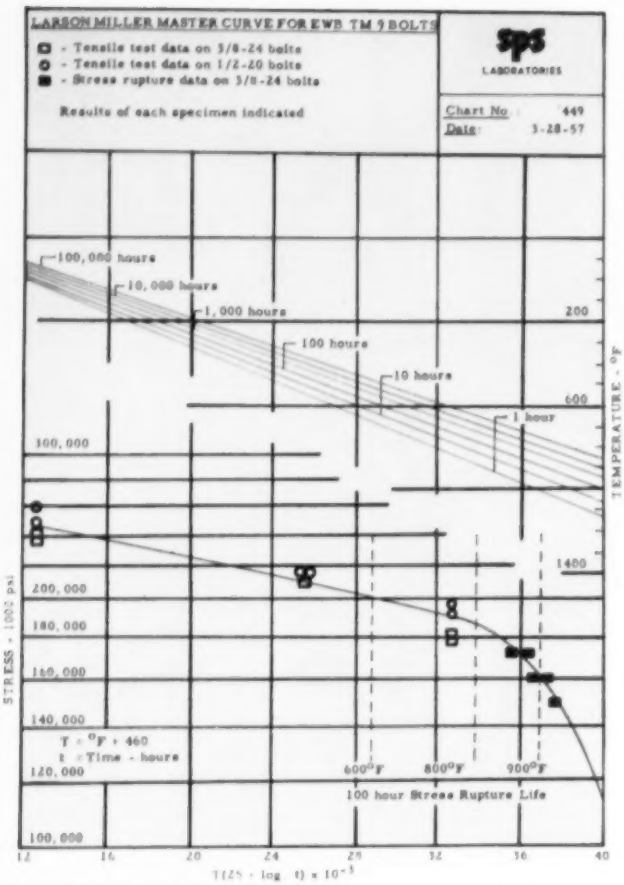
TENSION-TENSION FATIGUE TESTS of ⅜-24 EWB Tm 9 bolts showing values obtained when tested at room temperature and 900°F. It should be noted that the fatigue strength at 8,000,000 cycles is approximately the same at both test temperatures.



HIGH TEMPERATURE STRESS RUPTURE tests of ⅜-24 EWB Tm 9 bolts with EWN Tm 9 locknuts show a life of 1000 hr. at 140,000 psi (95%, of yield strength). Long life results from a combination of high strength material, new fabricating techniques, and advanced design, including SPS Hi R thread form. Hi R thread has a greater root radius than any other standard form; this reduces stress concentration at the weakest point of the bolt, and thus increases fatigue strength and stress rupture life.

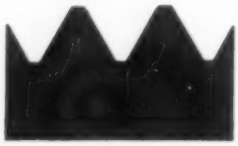


½-20 EWB Tm 9 BOLTS show high values for ultimate, yield and shear both at 900°F. and at room temperature after 100 hr. soak. Because they retain superior mechanical properties even after long exposure to elevated temperatures, the new EWB Tm 9 bolts offer airframe designers a solution to the problem of fastener deterioration at high Mach numbers.



FIRST LARSON-MILLER STRESS RUPTURE CURVES for a threaded fastener were plotted in SPS laboratories with data obtained from high-temperature tensile tests and stress rupture tests run on the EWB Tm 9 bolt. From these curves the stress rupture point in any given amount of time can be calculated. For example, for a life of 10,000 hr. at 900°F, it is shown that the EWB Tm 9 bolt will withstand a stress of 120,000 psi.

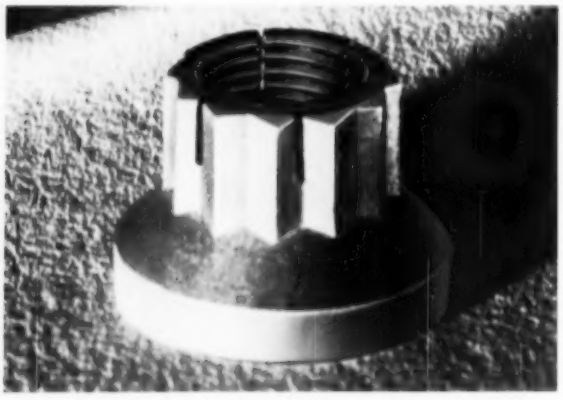
How SPS Hi R Thread Form Increases Fatigue Life



Unretouched Comparator Photograph of MIL-S-7742 thread. Flat thread roots with small radii cause points of high stress concentration which reduce fatigue life.

MIL-S-7742, MIL-B-7838a Threads. Larger (.0065 in.), more uniform radius reduces stress concentration, increases fatigue life.

Hi R Thread Form. Increased root radius (.009 in.) reduces stress concentrations still further for greater increase in fatigue resistance. Thread assembles with standard tapped holes and nuts.



EWN Tm 9 Flexloc Locknut Develops Full Strength of the EWB Tm 9 Bolt

The EWN Tm 9 self-locking nut is made of AMS 6304 material. It has ample strength to utilize the full tensile values of the EWB Tm 9 bolt at all temperatures up to 900°F. Configuration of the EWN Tm 9 locknut distributes the load over more metal threads than in conventional fasteners. Its design helps reduce stress concentrations to a minimum. Like its companion bolt, the EWN Tm 9 locknut is plated with a diffused cadmium-nickel capable of resisting the destructive effects of temperatures up to 1000°F.

For more information on SPS Tm 9 fasteners, write Aircraft Products Division, STANDARD PRESSED STEEL CO., Jenkintown 3, Pa.

STANDARD PRESSED STEEL CO.

AIRCRAFT PRODUCTS DIVISION

SPS

JENKINTOWN PENNSYLVANIA

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Britain May Use Princess In Atomic Aircraft Project

London—Britain's Ministry of Supply is considering use of a Saunders-Roe Princess flying boat as a testbed for its atomic aircraft program.

The three Princesses have been cocooned at Southampton since their development as commercial aircraft was written off, largely due to lack of adequate engines. Although considerable time and expense would be required to make them operational, the use of at least one of the flying boats might be an attractive proposal, particularly since the British have been concentrating on seaplane design for their atomic aircraft development program.

It is believed that the Bristol Proteus 755 turboprop engine might be used in the powerplant.

Dutch Company Will Build Fairchild Automatic Rifle

Fairchild Airplane and Engine Co. has recently signed an agreement with Artillerie-Inrichtingen allowing volume production of the former's Armalite automatic rifle (AW Oct. 8, p. 23) in Holland.

The Dutch firm will have production and sales rights in the Netherlands, Germany, France, Italy, Austria, Belgium, Luxembourg, Spain and Portugal.

Company plans to be tooled for production of the lightweight automatic rifle by next Jan. 1.

North American to Expand USAF Plant at Palmdale

North American Aviation Inc., will construct a 70,000 sq. ft. hangar, four acres of concrete flight ramp, a single point refueling center and enlarge its security center in a $1,712,000 Phase II construction program at its USAF Plant 42 site, Palmdale, Calif.

Site completion is scheduled for April, 1958. Architect and engineer firm is Woodford and Bernard. Construction contract is held by Manderbach Construction Co.

Lockheed to Install Cyrostat for Tests

Lockheed Missile Systems Division will install a cyrostat at its Palo Alto, Calif., research laboratories. Unit is intended to produce liquid helium which will be tested as a low temperature bath for avionic and other types of gear, and liquid helium for certain studies of unusual properties of the gas itself.

Cyrostat is to be installed in August, will produce 1,000 liters per month.

ENGINEER-OPPORTUNITIES AT RAYTHEON

AT RADAR ANTENNA IN OBSERVATION TOWER overlooking Raytheon's Flight Test Facility at Bedford, Mass., engineers work on vital missile projects in an informal atmosphere that stimulates creativity.

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Please send brief outline of your background to G. P. O'Neil, Raytheon Missile Systems Division, Box 6A, Bedford, Mass.

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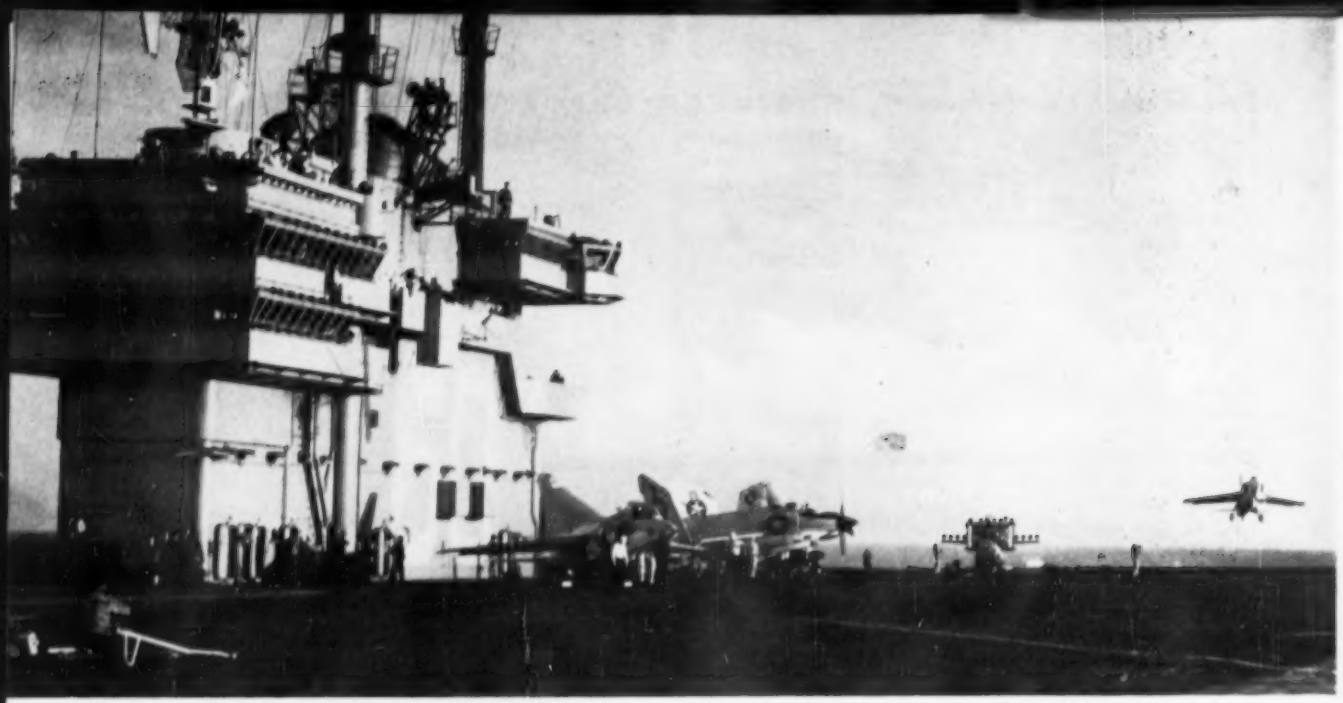
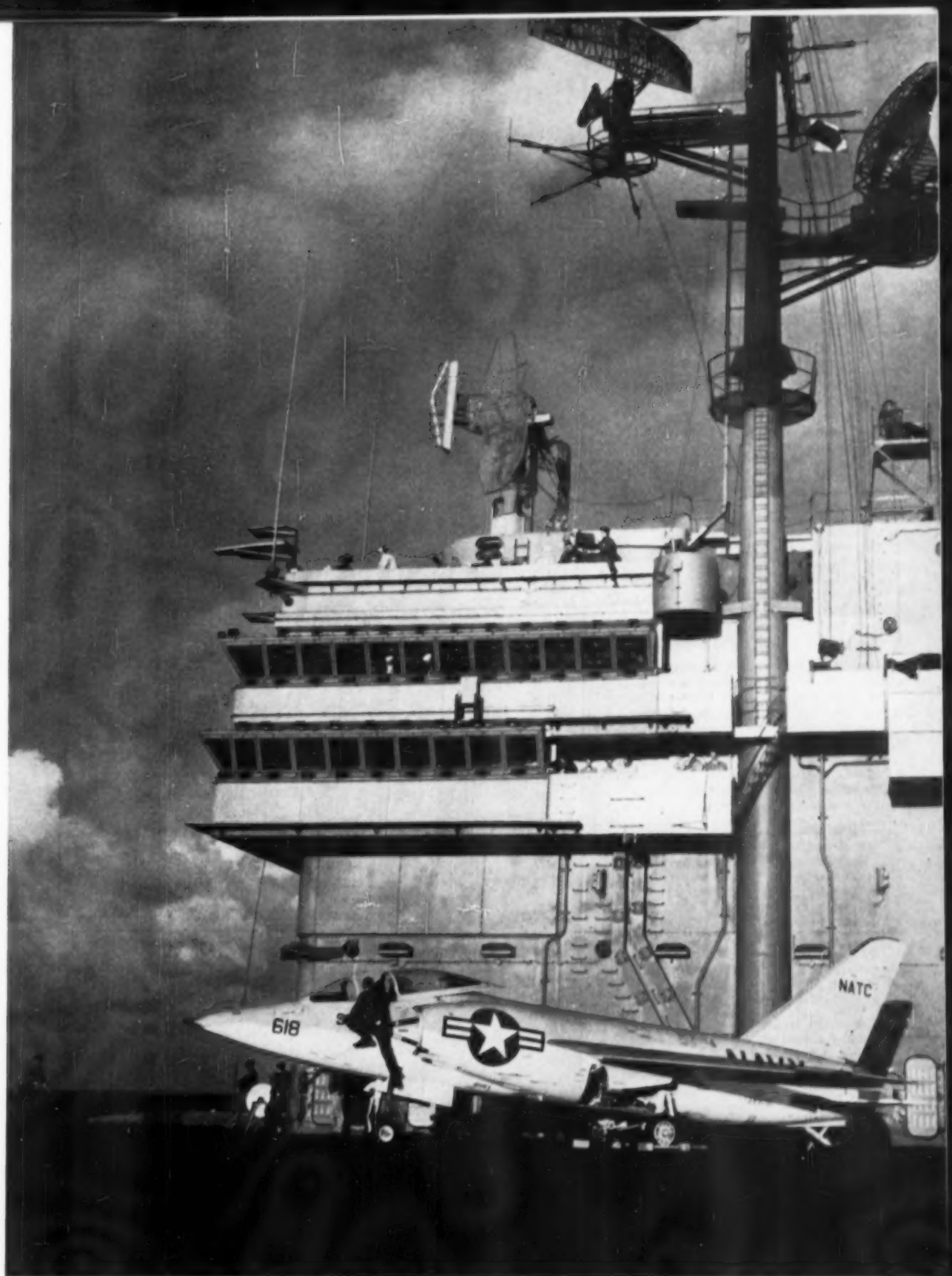


TAIL HOOK extended, Grumman F11F-1 is brought aboard the new 60,000 ton aircraft carrier Saratoga in carrier suitability trials in the Atlantic Ocean. Tiger is using mirror landing system (right, center). Approach utilizes canted deck which stretches out of view to right. Airplanes parked near island include McDonnell F3H Demon and Douglas AD Skyraider, creating optical illusion Demon is equipped with propeller.

F11F Carrier Suitability Tested on Saratoga

STEAM trails from catapult as Tiger is launched from Saratoga. Trials took place in early morning hours as shadows of deck handling crew and blast fence indicate. Blast fence retracts into deck. Saratoga's number 60 is visible on bow.



ISLAND of the big carrier overshadows F11F parked on deck. NATC markings indicate aircraft is assigned to Naval Air Test Center, Patuxent River, Md. Model is equipped with Curtiss-Wright J65 turbojet. Modification, the F11F-1F has General Electric J-79.

Career Opportunities For:

Research, Development and Production Engineers

MANY ADVANCED aircraft—like the F-27 on the facing page—are being equipped with Honeywell Aircraft control systems. And Honeywell Aero's advanced systems programs call for many more new developments for future aircraft of all types. These promise exciting careers in Minneapolis for engineers in these areas.

Inertial Guidance Systems • Digital Computers • Flight Control Systems • Jet Engine Power Controls • Engine Inlet Diffuser Controls • Air Data Computers • Bombing Computers • Fuel Management Systems • Vertical, Rate and Integrating Gyros • Transistor Amplifiers • Instrumentation.

Opportunity through growth! Engineering personnel at Honeywell Aero has more than tripled since 1951, and is still growing faster than the avionics industry average. Future growth looks even more promising, for rapid technological advances in the aircraft and missile fields are dictating more and more complex integrated flight control and weapons systems.

Developing and producing these systems is Honeywell Aero's business. Honeywell Aero pioneered the mass production of the most precise of all gyros—the floated gyro—is still the only manufacturer in the U.S. producing a complete line. Honeywell has produced over 45,000 flight control systems, more than any other manufacturer and has long been the leading supplier of LABS, the automatic low altitude bombing system.

Join the leader in this expanding field of aeronautical controls. Make Honeywell's growth, *your* growth and fill your future with opportunities.

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For more information about your career opportunities at Honeywell Aero, send your résumé to: Bruce D. Wood, Technical Director, Dept. TA1M, Minneapolis-Honeywell Aero Division, Minneapolis 13, Minnesota.

Honeywell

Aeronautical Division

High Speed Vehicles Compared

San Francisco—How long range hypervelocity vehicles—ballistic, skip or glide trajectory—compare in performance was described at the recent American Rocket Society meeting here by A. J. Eggers, Jr., of Ames Aeronautical Laboratory.

Eggers reports that the ballistic flight path is least efficient from the standpoint of the velocity required at burnout to attain a given range. An advantage is that convective heat transfer to the reentry body can be reduced by designing a blunt body to raise the ratio of pressure drag to friction drag. Effect is a lesser requirement for coolant.

The hypersonic glider, with lift-drag ratios of about 4, is much superior to the ballistic missile in ability to convert velocity to range. It has the disadvantage of receiving more heat by convection. Much heat can be radiated

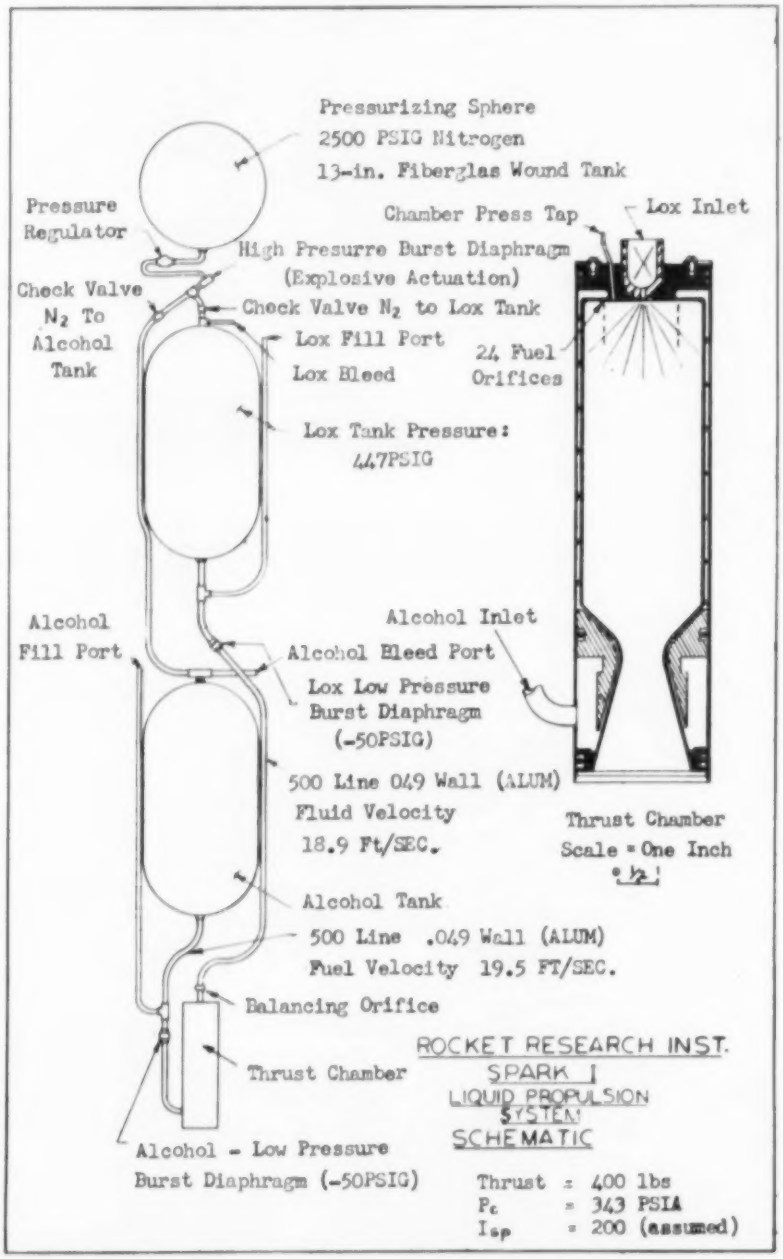

DIAGRAM of Spark I, a simple liquid propellant rocket for basic group training, shows details of liquid propulsion system. Design was revealed at ARS meeting.

Hailed as the DC-3's successor and scheduled for airline introduction in December, this 40-passenger Fairchild F-27 relies on a Honeywell Fuel Gage weighing less than 5 pounds installed. In addition to low power requirements this all-transistor gage is accurate to within 2%. It also has the ruggedness demanded by America's first short-to-medium-haul propjet. It's another example of Honeywell leadership in measurement and control systems for aircraft, missiles and rockets.

MINNEAPOLIS
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Transonic wind tunnel at Ohio State University is one of many facilities available to NAA engineers for advanced research.

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At North American Aviation's Columbus Division you will be part of a major aircraft engineering organization which commands facilities that rank among the finest in the world. Inside the plant itself the Engineering Department has at its disposal 16 fully equipped research laboratories, plus a wind tunnel now under construction. In addition, nearby Ohio State University cooperates in special research programs. Here also, many of our colleagues pursue graduate studies for their own professional advancement with the aid of our generous Educational Refund plan.

Situated within a 500 mile radius of most of the nation's finest aviation research and development facilities, the Columbus Division is in the very mainstream of today's technological progress. Full responsibility for all North American's Naval Aircraft projects is vested here, from concept to flight. This includes jet trainers such as the T2J . . . combat weapons such as the FJ-4 fighter and A3J attack weapons system . . . and others, even more advanced, still to come.

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Write: J. H. Papin, Engineering Personnel Manager, Dept. 56 W-7, North American Aviation, Inc., Columbus 16, Ohio.

THE COLUMBUS DIVISION OF

NORTH AMERICAN AVIATION, INC.

back to the atmosphere, keeping coolant mass requirements reasonably low.

The skip vehicle would probably prove to be the least satisfactory of the three types, Eggers said. It is comparable to the hypersonic glider in the ability to convert speed to range, but encounters severe aerodynamic loads and heating during the re-entry and pull-up phases of its flight. The ballistic phases of a flight can be described as segments of Kepler's planetary ellipses. (AW Mar 18, p. 72.)

High lift-drag ratio requirement of hypersonic glider and skip vehicle demands high fineness ratios and results in bad heating problems. One simple means of cooling which may be used is radiation.

Its usefulness is dependent on how hot the surface must get to radiate heat as fast as it receives it.

Simple liquid propellant rocket for basic group training in the field was unveiled by John W. Salter, George S. James and Daniel Starrett of Aerojet-General. Called Spark I, it burns lox and a solution of 75% ethyl alcohol and 25% of water. Propellants were chosen for ease of handling with a minimum of processing experience rather than for maximum energy release. The chamber is regeneratively cooled. It is about ready for firing after a year and a half of development. It is designed to produce 400 lb. thrust.

Hydrogen peroxide was not used despite advantages of no boil-off or ignition problems because of problems of maintaining hygenic standards and because there is less unclassified information available on its use. The designers also believe the bipropellants will be easier to obtain in many cases than hydrogen peroxide.

Preliminary performance estimates indicate a specific impulse of 227 lb.-sec./lb. at a mixture ratio of 1.26. Thrust coefficient is 1.48.

Fuel and oxidizer are pressurized by nitrogen at 2,500 psig. and regulated to about 450 psia. Burst diaphragms replace valves wherever possible.

RCAF Orders Firebee; Navy Increases Contract

Royal Canadian Air Force will acquire Ryan Aeronautical Co.'s jet target drone KDA-1 model Firebee, similar to that used by U. S. Navy. The drones will be air launched from Lancaster mother planes.

Canadian spares provisioning team, comprised of 14 specialists, recently visited the Ryan San Diego plant for a 10-day conference.

U. S. Navy has ordered an additional quantity KDA-1 Firebees in a contract exceeding $4 million requiring expanded production schedules well into 1958.

NATO Delays Fighter Race

Dassault Etendard IV fighter, powered by Snecma Atar 101-E4 turbojet delivering about 8,000 lb. thrust, may be a new competitor in NATO's lightweight fighter program which now has been postponed until mid-September.

Event, formerly slated to begin in early August, will be held at French Air Force test center at either Bretigny or Istres.

Reason for delay is that both Breguet Taon and Fiat G.91 are reported not yet ready to participate in the competition. Latter is still having tail trouble; first prototype was lost in flight because of the problem (AW June 10, p. 50). Special NACA team is working on this with Fiat.

Sud Aviation's Baroudeur, also in the race, in its present version is powered by Bristol Orpheus delivering over 4,000 lb. thrust. Dassault's other entry is the Etendard VI, also powered by the Orpheus.

Capt. Lionel Cano, Capt. André Lasieur, Paul Comet, Navigator, and Jacques Vergine, Flight Engineer, make up the Air France crew selected to present the Caravelle to the United States aviation industry and public.

THEY FLY THE FUTURE...TODAY

Today's air pioneers wear the stripes of Air France. These are the men who have been chosen to present the new jet Caravelle to the U.S. public and aviation industry. All have jet operational experience in both Caravelles and Comets. This will be invaluable in Air France's change-over to jets—Caravelles on medium-range routes in Europe and Asia...and Boeing 707's transatlantic. They are pioneering toward a future that will see a continuing record of dependable Air France service to the peoples of the world.

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Germans to Activate First F-84F Wing

By Claude O. Witze

USAF instructor points out location of F-84F drag chute to German student officers. Each German pilot gets more than 34 hr. of flying in the fighter bomber.

PREFLIGHT briefing at Landsberg Air Base. Piston-powered T-6 is one of program's mainstays. Average age of Luftwaffe veterans is 36.

THESE GAF students, shown at Kaufbeuren Air Base, will be part of some 2,600 pilots and 20,000 technicians necessary to man 1,326 jet aircraft four years from now.

Furstenfeldbruck AB, Germany—German Air Force, now about 18 months old, will activate its first wing of Republic F-84F fighter bombers within three months. The wing will be an operational training unit, preparing new pilots and veterans of the Nazi Luftwaffe for later transition to more modern aircraft.

For the present, there is no speculation in USAF or the GAF about what follow-on equipment may be provided but American officers assume the Germans will procure the best weapon systems they are competent to handle. By the end of 1958 there should be about four active wings in the GAF, starting the buildup to a 20-wing force by 1962.

Almost all the GAF will be tactical air. Two transport wings are programmed, with the rest of the force devoted to interceptor, fighter-bomber and reconnaissance aircraft. USAF spokesmen who have been in charge of the training program predict GAF personnel will make an easy shift to guided missiles if and when they are available for the mission.

Training Sites

Training program is conducted at a complex of three USAF bases in this part of Bavaria. In addition to Furstenfeldbruck, nicknamed "Fursty" by the Americans, major installations are at Landsberg and Kaufbeuren. First class of GAF pilots qualified in the Lockheed T-33 was graduated last September.

At that time the staff at Fursty got a new job of providing advanced fighter training. Today the field has a large number of F-84F aircraft marked with the German cross. Each GAF pilot gets more than 34 hours of flying in the fighter bomber, of which 11 hours are familiarization.

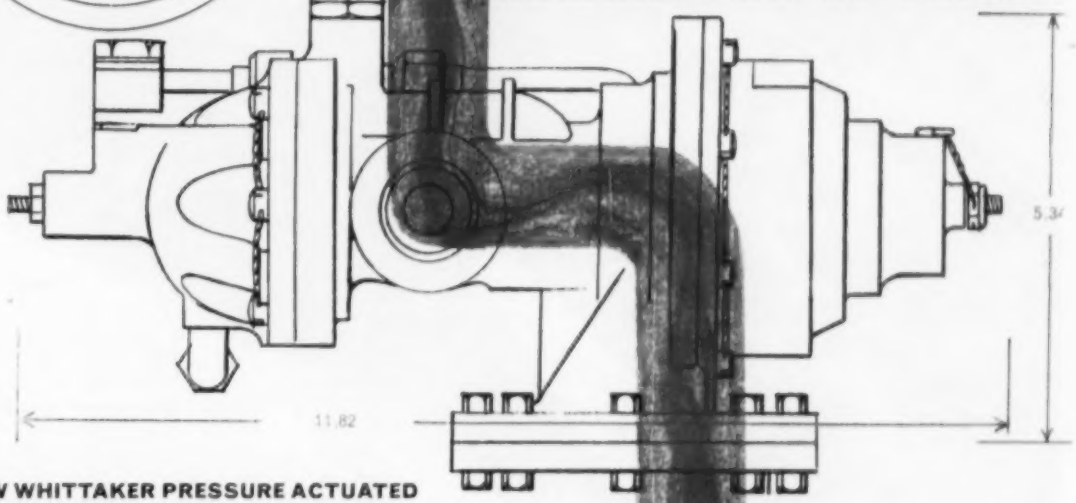
In addition, there is work on checks and emergency procedures, high speed maneuvers, supersonic dives and recoveries. Two hours of familiarization are flown at night. Acrobatics covers all maneuvers that can be utilized in air combat. Instrument training includes five hours in the C-11-B instrument trainer.

Col. Mark H. Vinzant, Jr., USAF base commander, told AVIATION WEEK the massive technical revolution in aviation of the past 12 years has combined with the inadequacies of Luftwaffe training to force increased emphasis on instrument work at this center.

Nazi pilots in the war years had specialized training to enable them to fly a particular aircraft on a limited number of types of missions. They really

25±1.5 P.S.I.G.

REGARDLESS OF FLOW!



THIS NEW WHITTAKER PRESSURE ACTUATED SLEEVE REGULATING VALVE—designed to regulate and maintain tank pressure at a constant value—reduces high pressure helium or nitrogen to a low pressure and pressurizes fuel and/or oxygen tanks.

With a 3/4" tube size it permits the flow of helium to vary from zero to .15 lbs. per second.

This device includes two reducing stages to assure stable operation, regardless of flow variation, and is controlled by a remotely located sense line. This signals the actual pressure in the low pressure line leading from the unit to the tank.

This unit is now installed in one of the latest IRBM's. It is now in production, and with calibration settings changed to provide any specified requested pressures, it can be used for many other applications.

PERFORMANCE

TEMPERATURE	Ambient, —65°F to +160°F Fluid, —65°F to +160°F
PRESSURE	Operating (inlet) 3000 PSIG (Outlet) 25 ±1.5 PSIG pressure to be maintained in tank. Proof 4500 PSIG—Burst 7500 PSIG
SERVICE	Nitrogen or Helium (in the presence of kerosene vapor)

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The Surveillance and GCA radars serving airports are designed for virtually continuous performance. In most of these radars you'll find Raytheon magnetrons and klystrons—*to insure utmost reliability.*

C.A.A. records show, for example, that the Gilfillan ASR-1 radar at Boston gave 8,760 hours of performance with less than 1/10 of 1% involuntary downtime—proof of the reliability of the Raytheon tubes in this equipment.

Raytheon is the world's largest maker of magnetrons and klystrons and other microwave tubes—a major achievement that has furthered its reputation for "Excellence in Electronics."

Excellence in Electronics

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LT. GEN. JOSEF KAMMHUBER

had no good overall cockpit education. Result is that the new GAF training program for these men includes a high percentage of time on instrument and communications problems.

Personnel Needs

To man 1,326 first line jet aircraft four years from now, GAF will need about 2,600 pilots and 20,000 trained technicians. Initial effort to enlist Luftwaffe veterans fell far short of expectations. So far about 300 men have reenlisted and their average age is nearly 36 years. When the program was launched early in 1956, German defense officials expected at least 1,100 of Hermann Goering's old heroes to answer the call.

Col. Vinzant does not attribute this to lack of enthusiasm for the NATO cause or underestimation of the Soviet threat to Western Europe. He believes it is economic, that most air veterans are comfortable and well-fed in the flourishing German economy. Pay standards for the GAF are about one-quarter of those provided by USAF.

There is a personnel screening hur-

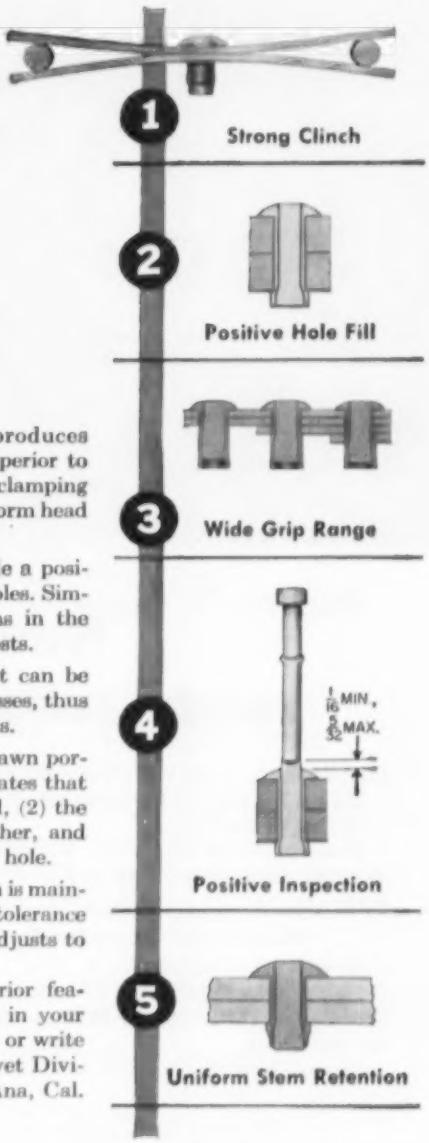
German Production

Furstenfeldbruck AB, Germany—The United States has given 250 airplanes to the German Air Force, and there is no indication that the country intends to produce its own modern jet fighters.

Only German-made aircraft now being procured is the Dornier DO-27, a high-performance observation plane for use by the Army. GAF may at some time purchase locally-designed trainers but there is no program under way as yet.

Army pilots are trained by the GAF at Memmingen, a fourth pilot training center about 85 miles from Munich. Both fixed-wing and helicopter crews are trained there, then returned to their Army units.

Five reasons why Cherry "700" rivets* give you superior fastening



1. The "700" rivet design produces sheet clamping action that is superior to any other blind rivet. This same clamping action guarantees consistent uniform head seating.

2. Cherry "700" rivets provide a positive hole fill, even in oversized holes. Simplifies hole preparation problems in the shop and reduces hole drilling costs.

3. Wide grip range. One rivet can be used for several material thicknesses, thus reducing stock and lowering costs.

4. When installed, the wire-drawn portion of the stem, as shown, indicates that (1) a blind head has been formed, (2) the sheets have been clamped together, and (3) the rivet has expanded to fill hole.

5. High uniform stem retention is maintained within a greater hole tolerance range because the stem always adjusts to fill the hole.

Let us demonstrate the superior features of the Cherry "700" rivet in your shop on your trouble spots. Call or write Townsend Company, Cherry Rivet Division, P. O. Box 2157-N, Santa Ana, Cal.

Patents issued and pending

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F-105 Thunderchief

New Thunderchief ready soon for lightning strikes

Here's Republic's lightning-fast F-105 fighter-bomber.

It's the latest of the famous "Century Series" planes to go into production.

Powerplant for the nuclear bomb-carrying Thunderchief is the mighty Pratt & Whitney Aircraft J-75 turbo-jet.

Nickel alloy chosen for afterburner

In the Thunderchief, as in other supersonic jets, a high temperature nickel alloy is specified for the afterburner shell of the J-75 — a critical high temperature zone.

Here, Nimonic 75 nickel-chromium alloy is relied on for outstanding strength and corrosion resistance demanded at the intense heat of after-burner operation. And on the production line, Nimonic 75 pays dividends by providing the fabricability demanded by today's production schedules.

If you're looking for a special combination of properties in a nickel alloy, it may pay you dividends to investigate Nimonic 75 or one of the other Inco Nickel Alloys. Just get in touch with Inco's Mechanical Engineering Section.

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Monel
Lock wire
Fine fuel line tubing
Rivets

"S" Monel
Ball bearing retainer rings

Pure Nickel for electrical and electronic gear. Primary Nickel as alloying element in other materials. Inco Precision Castings in many different alloys.

GAF Safety Record

Furstenfeldbruck AB, Germany—The 18-month-old German Air Force probably has one of the finest safety records of modern military air training.

Its pilots have flown about 60,000 hours since the beginning of last year. Approximately 26,000 of these hours were in T-33 and F-84F jets.

There has been one fatality.

dle where political ideas and activities are examined by a loyalty board, but this applies only to men seeking a commission above the rang of lieutenant colonel.

GAF commander is Lt. Gen. Josef Kammhuber, who was an infantryman in World War I and an active bomber and fighter pilot in World War II. As early as 1943 he had serious disagreements with Hitler and was given unsavory commands until the end of the war.

Maj. Gen. Joachim F. Huth, chief of the GAF Training Command, was a fighter pilot in the World War, during which he was wounded four times and lost one leg. Under the Nazis he was back in action as commander of a fighter-bomber wing on the Western Front. Until the GAF was organized he was a farmer and insurance firm manager in Stuttgart.

L-18 Screening

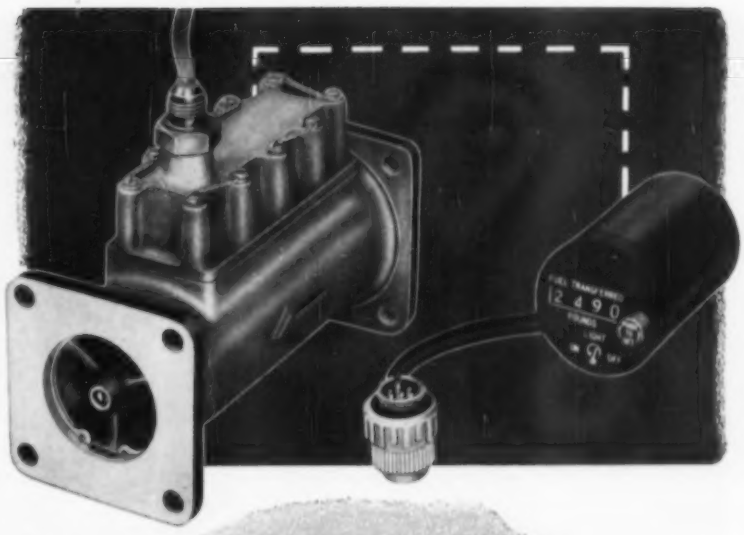
For the long run, GAF is training about 500 new cadets who start with 15 hours in an L-18 Piper Cub. Once the misfits are weeded out, they move with the retreads from World War II into the T-6 and then to T-33 training. For a start, about 700 German youths took basic flight training in the United States and Canada. First 28 of their number will move into advanced jet training at Fursty in mid-July.

In addition to jet training, Fursty is used for indoctrination and training of instructors. There are 204 hours of flying and 108 hours of ground school in the 15-week course at this field.

At Landsberg AB both cadets and veterans receive training in piston-powered L-18s and T-6s. Instructors for these aircraft also are trained here.

Third base in the training complex is at Kaubeuren, home of the technical training school. There are 38 courses running from eight to 23 weeks. They cover aircraft maintenance, communications-electronics, air traffic control, armament, weapons, photography, intelligence and supply.

USAF instructors at Kaufbeuren are qualifying GAF personnel to take over management of the school. Known German aptitude for this kind of work eases the burden but GAF still has a long way to go. In the end it will need



Revere FLOWMETER used in BUDDY-SYSTEM REFUELING

...No "Black Boxes" Needed

Buddy-system inflight refueling means greatly increased range and striking ability for carrier-based aircraft. The Revere Flowmeter System, used in this new method of mid-air refueling and now being produced for two Navy prime contractors, *totalizes flow accurately and dependably without the use of "black boxes" or vacuum tubes.*

The output signal of the transmitter, shown above, is fed directly into the electrical counter, eliminating the need for external electronic amplification.

Various impulse-flow ratios, flow rates to suit your totalizing applications. Rate of flow indication also available.

REVERE CORPORATION OF AMERICA
Wallingford, Connecticut
A SUBSIDIARY OF NEPTUNE METER COMPANY

neptune

"FLYING SAUCER" FILTER solves R-F NOISE problem

The usual black box filter was out of the question. Too much bulk to fit the oddly-shaped space available . . . too little room to add components elsewhere in the system . . .

But the problem was solved by taking advantage of Sprague's assortment of designs including rectangular and cylindrical filter elements. Those needed were taken from the shelves and packaged together in the "flying saucer" shape illustrated.

Chances are that Sprague's filter elements will add up to the fastest, most economical and efficient solution to many of your filter problems . . . whether you package them yourself, or Sprague assembles them for you. But if not, you can depend on Sprague's three filter research and development laboratories, complete facilities for special tests and measurements, library of more than four thousand proven filter designs, mass production facilities on the East and West Coasts, and field engineering consulting service.

If you have an interference problem, pick up your phone and call your nearest Sprague Electric Field Engineering Laboratory. They are located at 12870 Panama Street, Los Angeles 66, Calif. (TExas 0-7531); 224 Leo Street, Dayton 4, O. (ADams 9188); 327 Marshall Street, North Adams, Mass. (MOhawk 3-5311).

see SPRAGUE® for filters

20,000 trained technicians and there should be 3,000 students in the Kaufbeuren classes at all times.

Spokesmen for USAF say they plan to turn over some operational responsibility to GAF before the end of this year, probably with the activation of the first of GAF's 20 wings at Buchel.

German industry has assumed the job of providing maintenance facilities and replacement parts wherever possible. Col. Vinzant says USAF supplies only "hard core" items such as communications and electronic equipment in addition to the fighter and training planes themselves. In the near future, Canada will provide a number of Canadair-built F-86Fs.

Total strength of GAF today runs in excess of 10,000. Authorized strength figures are not available but Col. Vinzant estimates GAF eventually will constitute about one-third of the entire German military force of 500,000 men.

Transocean Acquires Atlas Subsidiary

Los Angeles—First step in a major development program was taken by Transocean Corp. of California by acquisition of the Babb Co., Inc., wholly owned subsidiary of Atlas Corp.

Under the terms of the agreement, the present management of Transocean will assume full responsibility for the operation of the merged company. A second step in the overall program will be the public offering of Transocean securities to provide approximately $6.7 million in new working capital and for the immediate purchase of long-range Lockheed Constellations.

The Babb Co. has overhaul facilities at Phoenix, Arizona, Linden, N. J., and St. Johns, Quebec, and is a large dealer in aircraft engines and parts.

Britain's May Exports Total $29 Million

London—Britain exported $29 million worth of aviation products in May to set a high mark for 1957.

Aviation exports brought in about $5.6 million more than in May, 1956.

Aircraft and parts accounted for $18 million and engines $9,450,000. Electrical parts and appliances, tires and instruments also were exported.

Total for the first five months of this year amounts to $120,176,000, of which engines account for one third.

Sweden was Britain's leading customer last month, buying $11,126,000 worth of aircraft and parts.

The United States was next, with $10 million worth of orders. Then came India, Canada, France and Australia.

A SPECIAL BREED OF CAT...

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...and the divisions of H & B American Machine Co., Inc. offer you the specialized skills and equipment needed to produce these parts on schedule and of the highest quality.

Convair F-102-A

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Indianapolis, Indiana

Illustrated above are typical structural machined aircraft parts and assemblies currently being manufactured in the two divisions. The aircraft divisions operate under Air Force approved Quality Control systems. Each division possesses the most up-to-date equipment for its specialty including many pieces of equipment designed around a particular part. . . . . .

Convair B-58

Boeing B-52

H&B AMERICAN MACHINE CO., INC.

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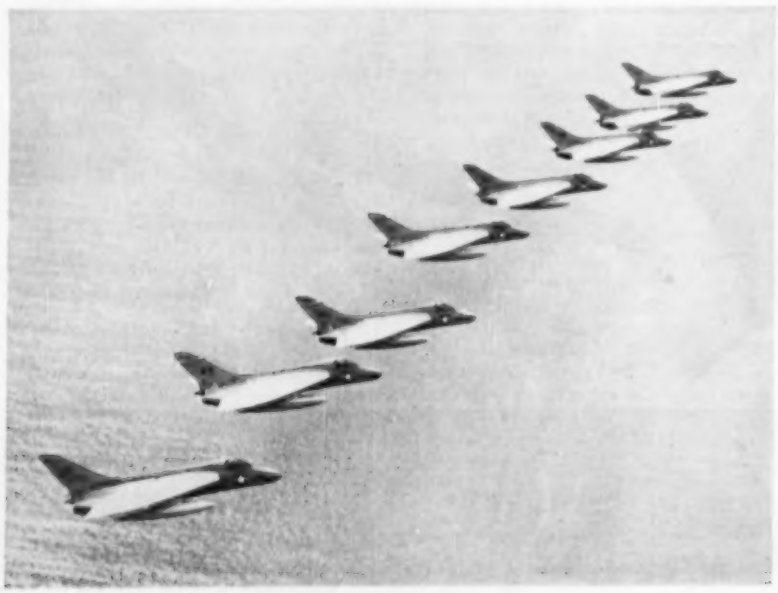
Marines Fly FJ-4s, F4Ds

Marine Fighter Squadron 323, based at El Toro, Calif., recently completed carrier qualification in their North American FJ-4 Furies. Top photo and other pictures of squadron show that only one fighter in division appears to carry refueling probe, which extends from left wing of No. 3 airplane. Squadron, nicknamed "Death Rattlers," is commanded by Lt. Col. Daniel L. Cummings. All Weather Squadron 115 (below) was first to receive Douglas F4D-1 Skyrays. Squadron also is based at El Toro.



$T = 2\pi\sqrt{\frac{R}{g}} = 84$ MINUTES

In support of the 2000 engineering personnel that have made this equipment possible, are 4000 highly trained production technicians located in 14 Kearfott plants in New Jersey, North Carolina and California. To support this highly technical equipment in the field, Kearfott service and repair facilities offer the following services to both military and commercial users of Kearfott products and systems.

FIELD SERVICE
Any base, any plant, at any time.

SERVICE TRAINING
Operation, maintenance, overhaul.

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Air conditioned facilities in Little Falls, N. J. and Pasadena, California.

HANDBOOKS AND SERVICE PUBLICATIONS
Installation, Operation, Repair, Overhaul, Parts Identification.

TOOLS AND TEST EQUIPMENT
Incoming Inspection, Flight Line, Repair Overhaul.

SPARE PARTS, PROVISIONING ASSISTANCE, DRAWINGS, STOCK
Regardless of application, Kearfott offers the components or systems necessary for precise airborne control or navigation with the facilities to produce in quantity and to service in detail.

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M. SCHULER, 1923

$T = 2\pi\sqrt{\frac{R}{g}} = 84$ MINUTES

Inertial Guidance was made possible only after 30 years of developing precise enough components to instrument the earth's radius pendulum. For more than 10 years, Kearfott has been developing and producing floated gyros, accelerometers and computer elements for inertial applications. For over 7 years, these components have been applied to the inertial systems now in development, flight test or quantity production at Kearfott. Today, Kearfott is unique in the field of inertial guidance. By virtue of the components now available and the developments under way, coupled with our experience in precise navigation systems and inertial guidance, only Kearfott offers the advantages this experience implies.

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INERTIAL SYSTEM PLATFORM

This three gyro inertial platform is representative of the units now in production at Kearfott. It incorporates accelerometers, floated rate integrating gyros, data transmitting components and basic structural designs which exemplify the current state of the art.

Kearfott also manufactures the integrators and computers associated with this platform to provide precise inertial auto-navigators for every airborne application.

Supplementing the Inertial Guidance Systems, there are in production at Kearfott, precise 3 axis reference systems typified by the examples illustrated below.

CENTRAL GYRO REFERENCE SYSTEM

Based on a 3 gyro 3 gimbal 25 pound stable platform, this system provides a precise vertical reference (2 milliradians under all dynamic flight conditions) and serves as an all-latitude Compass System with 1° per hour random drift rate.

ALL-ATTITUDE COMPASS SYSTEM

The 3 gyro 4 gimbal platform illustrated weighs 23 pounds. It provides a precise all-latitude compass system for high performance fighter aircraft. Azimuth drift rate, less than 1° per hour. Also provides precise vertical reference.

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GENERAL PRECISION EQUIPMENT CORPORATION

FLY WEATHER-WISE

Mobil

These weather items prepared in consultation with the United States Weather Bureau

WEATHER AND RADIO

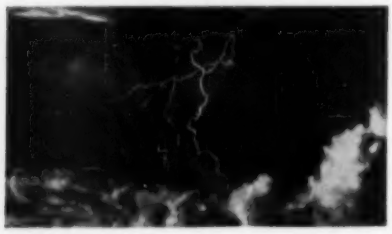
HOW WEATHER CONDITIONS AFFECT THE PROPAGATION OF RADIO WAVES

RADIO RECEPTION may vary from poor to exceptional, depending on the temperature stratification. Temperature inversions alter refraction characteristics of the atmosphere. This can result in freak reception over great distances on VHF channels.

Precipitation static—ice crystals, snow flakes and rain droplets striking aircraft can cause crackling in headphones.

Static due to lightning discharges. These occasional bursts and crashes can be picked up at considerable distance. It is often your first indication of thunderstorm activity.

How to minimize static: Change altitude if it can be done safely. Decrease speed in rain or snow storms. Where possible, avoid dry snow and cirrus clouds composed of ice crystals. Keep radio volume turned low to reduce background noise. It is preferable to use a higher frequency broadcast station for ADF homing instead of low frequency range station. During periods of static, push headphones over temples when not listening—to keep fatigue to minimum.



Aurora Borealis, associated with magnetic storms. These extra-terrestrial phenomena cause communication fadeouts. Tune in to Time Signal Broadcasts of National Bureau of Standards (5 or 10,000 kilocycles for forecasts of periods of poor reception).

NEW MOBILGREASE AERO LO-TEMP

For improved performance, added protection and reduced maintenance of grease lubricated parts—*including instruments, where protection from corrosion and minimum frictional drag are particularly important*—specify Mobilgrease Aero Lo-Temp.

For Top Flight Performance—Make it **Mobil** *Leader in Lubrication for 91 years*

SOCONY MOBIL OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM CO. GENERAL PETROLEUM CORP., MOBIL OVERSEAS OIL CO., INC.

TWENTY stories above Union Square in New York, TRG engineer and technician prepare radar antenna for test. Small shock tube in TRG's penthouse laboratory (right) is used to investigate means for chemical manufacture and supersonic flow study.

Air Problems Attacked in Mid-Manhattan

By Robert Cushman

Growing tendency of scientists to form independent teams to sell their analytical talents to the armed services and industry is illustrated in the offices and laboratories of TRG (Technical Research Group) in mid-Manhattan, New York City.

Here in a mid-Manhattan location, mostly known for bargain department stores and soap box orators, a team of scientists, under the management of fellow scientists, is working on problems of optimum shielding configurations for the USAF nuclear bomber (WS-125), supersonic flow and radar antennas.

Job Shop

TRG is one example of the "scientific job shop," a type of firm which has become of particular interest because of the industry-wide shortage of scientifically trained manpower. Unlike their counterpart, the design job shop, the scientific job shops have often proved their inherent capacity to blossom into full-fledged industrial firms.

Ramo-Wooldridge Corp., Los Angeles, Calif., has been cited as the classic example of this type of outfit. Another example is NDA (Nuclear Development Corp. of America), White Plains, N. Y. Both of these firms are now considered substantial industrial firms.

Other Examples

Other examples, which like TRG have not yet branched out and acquired sufficient assets to be considered substantial but appear to have the technical potential to do so, are Acrokinetics, formed by Princeton University scientists to consolidate their outside consulting work (AW Aug. 13, p. 67), and General Nuclear Engineering Corp., Dundeen, Fla., formed by Dr. Walter H. Zinn, former director of the Argonne National Laboratory.

The one thing that the various examples of this type of firm appear to have in common is their rapid growth. They often expand from a handful of founding members to many times the original numbers. In a few years, however, they often feel growing pains which are diagnosed as "lack of management know-how."

Then there is a crisis out of which the successful ones emerge, very likely with the aid of outside capital (AW Dec. 31, p. 67), transformed into substantial members of the industrial community. Others like IRL (Industrial Research Laboratories), Baltimore, Md., which is now research and development division of Acronca Manufacturing Corp., Middletown, O., are purchased by companies which feel they are short in R&D engineering talent.

TRG is in the growth phase. In three years it has grown from a few founding members to almost 100 employes. In this phase its income is derived from an assortment of theoretical study and development jobs. Though TRG does not consider itself an aeronautical firm, 90% of its present income comes from research related to aircraft weapons systems.

Wide Diversity

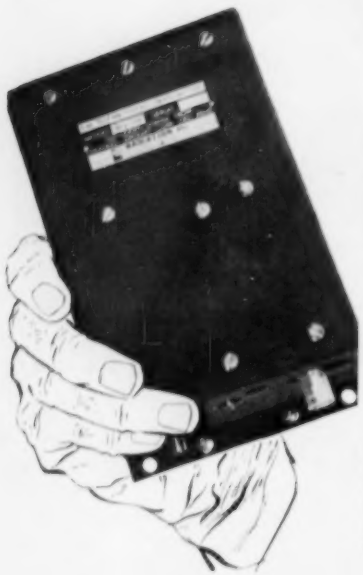
TRG's diversity is remarkable. Its projects include nuclear reactor physics; radiation damage to materials; high temperature metallurgy; electromagnetic problems associated with missile reentry; radomes; rapid scanning antennas; antennas for high speed aircraft; doppler radar; low noise maser amplifiers; atomic frequency standards; and supersonic flow.

Explanation of TRG's ability to handle this scope of fundamental work is the fact that almost all of its employes are men with degrees being utilized in the fields of their well-de-

FM TELEMETRY TRANSMITTER

- small size
- low distortion
- high reliability
- high frequency stability

Model 3115 Transmitter



New, improved model designed for extreme enviromental conditions (100g shock, 2000 cps vibration, —55 to +75°C). Subminiaturized and crystal-stabilized with telemetry band spurious output better than 60db below carrier.

Frequency Range: 215-235 mc
Frequency Stability: 0.01%
Power Output: 2 watts
Weight: 1.7 pounds

Write P. O. Box 37, Melbourne for complete data and prices.

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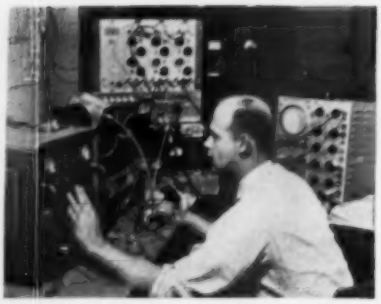
Personnel Inquiries Invited



DR. RICHARD DALY, a TRG group leader, works on Army nuclear resonance project.

fined professional interests. Twenty per cent of these men have their Ph.Ds. In many cases one or two of them represent a department in themselves.

Dr. Thomas Goldsmith, Jr., vice president in charge of government research, Allen B. Dumont Laboratories, Inc., N. J., said TRG is able to handle many more complex problems than ordinarily would be associated with so small a firm because of this strongly individualistic and professional slant.

Goldsmith, whose laboratory is a client of the company, said he would compare TRG with Ramo-Wooldridge Corp.

TRG is a partnership of five of its senior technical members: Dr. Raphael Aronson, nuclear physics; Dr. Lawrence Goldmuntz, radar systems; Dr. Kalman Held, chemistry and materials; Dr. Alan Kay, microwaves and electromagnetics, and Dr. Jack Kotik, mathematics and hydrodynamics.

Although most of TRG's contracts at present are of a short term consulting or study nature, TRG's partnership does not like to think that the company is limited to "scientific job-shopping." Despite the limitations of its office building location, it has a gas dynamics laboratory with three shock tubes—two periodic and one single shot—a microwave antenna range with darkroom and interferometer, a metallurgy laboratory, and spectroscopy facilities that now include nuclear resonance and are being extended to include microwave spectroscopy studies.

Atomic Clock

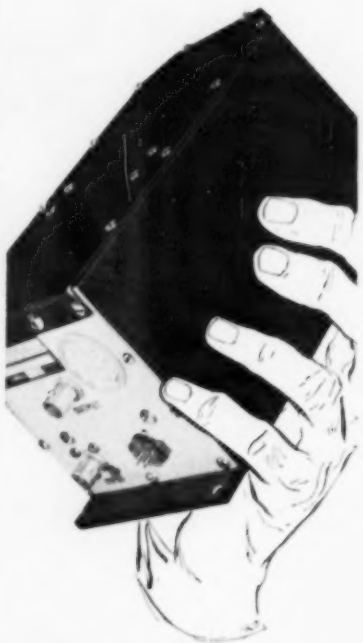
Eventually, the firm hopes to go into manufacture of some proprietary projects like its "atomic clock."

Atomic clocks use nuclear resonance as a time standard. In practice they may use the nuclear resonance to monitor the output of a crystal oscillator within such narrow tolerances that the error would only amount to 3 seconds in 100 years (AW Oct. 22, '56, p. 103.) They are being considered wherever a very accurate self-contained time source is needed. Martin Company's RIAS

RF POWER AMPLIFIER

- rugged
- compact
- reliable

Model 3052 Amplifier



Provides 50 watts output from 2 watts input. Rugged construction and the use of a stacked ceramic tube makes this amplifier stable and reliable over a wide range of environmental conditions:

Temperature: —55° to +75°C
Shock: 100g
Vibration: 20g, 20-2000 cps
Altitude: 0-70,000 feet

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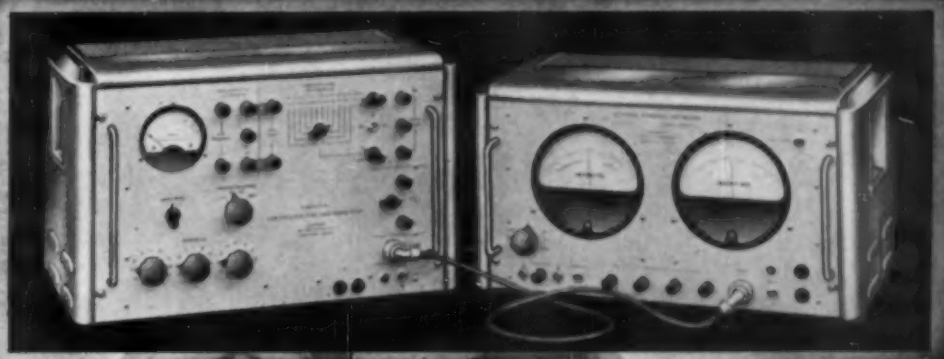

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subsidiary is considering them for its gravity experiments. Rome Air Development Center plans to use them to implement the Navarho navigation concept which measures the time an electromagnetic wave from a ground station takes to reach aircraft.

Still another use for atomic clocks mentioned by TRG is for synchronizing the very short "on" pulses of ground beacons while a country is under attack so that these aids may be used for the defending interceptors and retaliatory bombers but not be available for the enemy attackers. In this use, very short "beeps" would be sent out from the ground beacons according to a irregular but coded schedule.

The friendly aircraft equipped with the code and atomic clocks would know precisely when to expect the pulses. Meanwhile, the unprepared enemy would not be able to benefit.

Many Agencies

TRG has worked for a large number of government agencies in its short life. It has had contracts from the Cambridge Research Center, Wright Air Development Center and the Office of Scientific Research. Recently, after a presentation to ARDC, Baltimore, TRG was qualified for a "systems requirement release" on the anti-ICBM program.

Anti-ICBM systems must in less than one minute sense ICBM nose cone heat as it plummets down through the upper atmosphere from, say, 300,000 ft., and send up intercepting missiles.

Besides USAF agencies, TRG has worked for the Office of Naval Research, The Applied Physics Laboratory, Johns Hopkins and the Oak Ridge National Laboratories. General Electric Co., Olin Mathieson Co., Allen B. DuMont Laboratories and Brunswick-

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PIP Pin connection of hydraulic actuator to dive brake fitting answers Lockheed's design requirements for a safe, trouble-free lock pin capable of withstanding high shear loads and providing quick removal and interchangeability of the dive flap assembly without requiring nuts, washers, safety cotters, etc. In addition, PIP Pins offer drive-in drive-out features for easy insertion or removal when hole misalignment or normal structural variations bind the pin. A blow on the head or tip with a plastic mallet permits retaining balls to recede into body of pin as pin drifts in or out.

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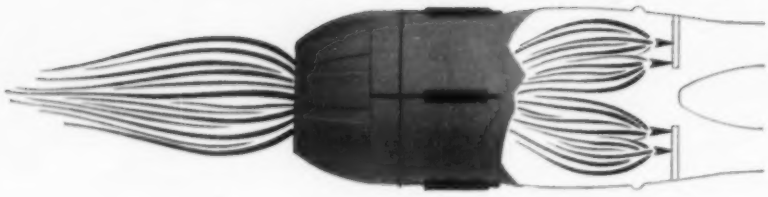

Starter! Pressurized! Fire!

And another J57 jet engine tunes up in one of our test cells. To look at that big monster belching flame with a rhythmic whine you'd think all production jobs on it were finished. After this testing, it should be merely a matter of a careful final inspection before shipping this jet engine.

But *this* is where we start all over again. Every J57 engine is built, tested—*then torn down completely and inspected.* The engine is then rebuilt and given a final testing. Only at this point is it ready to be submitted for acceptance. This is the way these engines are built.

Admittedly this is a very careful process—but it's the way of making sure these Ford-built engines do everything expected of them, under all conditions.

These J57 jet engines *must* be dependable—a lot of people are depending on them.

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Balke Collender Co. have been among its industrial clients.

The increasing formation of "scientific brain trust" firms like TRG should be of some encouragement to many small to moderately large manufacturing firms that want to either get into (or just as important, stay in) defense business despite the armed services preference for firms with a preponderance of engineering talent. This is becoming more and more pronounced under the weapons system type of procurement. By arrangements like plastic radome manufacturer Brunswick-Balke Collender Co. has with TRG, it is possible for a production firm to be in a more competitive bidding position, yet not go into all the many tribulations of trying to build up and keep happy a large engineering group.

Recruiting Ease

Many firms that are constantly running heavy recruiting programs would envy the success which young TRG has had in attracting and holding top level men. Apparently TRG's success in this respect is not so much one of high salaries as the opportunity to join an organization run by scientists for scientists.

Alan Oppenheim, (M.S. New York University), one of the first employes to join TRG, told AVIATION WEEK "in this firm you are allowed to slant your work towards your own professional interests. It is a nice balance between the often too-academic atmosphere of many universities and the usual impersonal atmosphere of most manufacturing companies."

However, firms like TRG also have problems. For one thing, one observer of the situation has told AVIATION WEEK that under the new weapon systems concept the trained men in the government agencies, such as at Wright Field, who formerly bought research and development from small firms, are being by-passed. In their place the small companies have to deal with agents of the large private firms which USAF has awarded the huge weapon systems contracts.

Small Firm Plight

Though there are many good things about the weapons system concept, said this observer, the plain result so far as the small companies are concerned is that the big fellows naturally use every excuse to grab as much of the research under their own wing as they can. Naturally they want to make sure they have proprietary ownership and in-house know-how on all phases of the new weapons system so they will be in top position to bid on succeeding weapons systems. This tendency to grow to the limit of a weapons system management contract rather than farm it out is especially true of R&D, the observer commented. In fact the large companies claim that they must do all of the important research under their own roof because they need the knowledge to manage the systems.

The reasoning is understandable—but it does not leave the happiest outlook for the small research firm.

Airline Radiation Hazards Discussed

Radiation hazards—a growing concern in aircraft operation because of the increasing use of airborne radar and X-ray inspection—was one of several subjects considered at a recent meeting of the National Safety Council Air Transport Section held at Marinette, Wis.

Safety precautions relating to servicing airborne radar equipment and to X-ray inspection of aircraft and their components are currently under preliminary study. Members at the meeting recommended that a data sheet on procedures for these two types of work be prepared by the Aeronautical Industries Section of the National Safety Council. The data sheet would be used by each airline in drawing up its own permanent regulations for these functions.

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Navy Unveils APN-67 Doppler Navigator

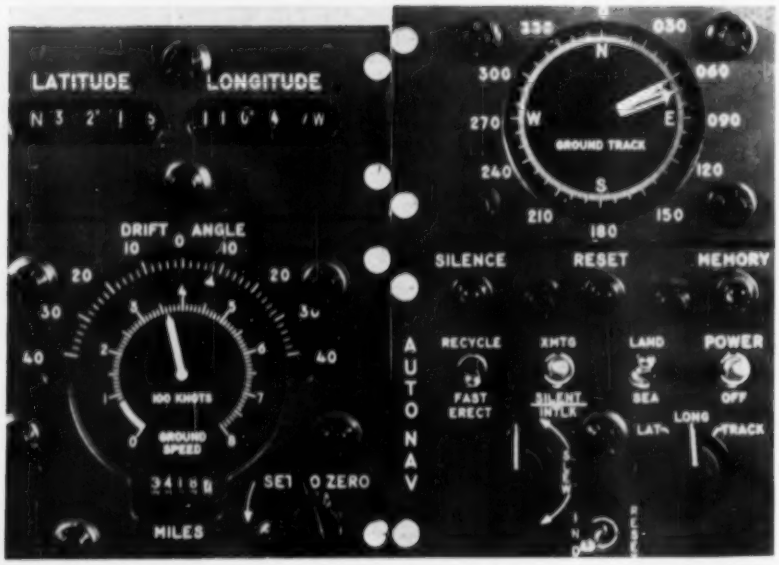
By Philip J. Klass

First details on its AN/APN-67, a 200-lb. self-contained doppler automatic navigation system which gives the pilot his true ground speed, distance traveled, drift angle, deviation from desired course and his present latitude and longitude were revealed by Ryan Aeronautical Co.

Overall system errors are quoted at about 1%, with distance traveled error less than ¼%, neglecting errors in the heading reference and sea motion when used over water.

The APN-67, in pilot production for the Navy, is one of 13 U. S. doppler auto-navigator systems recently declassified by the Defense Department. Declassification followed similar action by Britain and Canada on doppler systems that were developed by British and Canadian Marconi companies.

This opens the way to civil use of the technique which has proven so valuable in military operations, particularly over areas not equipped with ground-based aids. Interest of the international airlines was evidenced by their large turnout in Miami for the Arinc Airline Electronic Engineering Committee (AEEC) meeting where doppler systems were a major agenda item.



AN/APN-67 doppler auto-navigator gives pilot his present position (latitude and longitude), drift angle, ground speed, distance traveled, ground track and deviation from desired course without reference to any ground-based navigation system.

Lightweight Claim

Ryan says its APN-67 is the lightest weight doppler auto-navigator now in production, a claim which may hinge on the definition of the word production. Several other lightweight systems are currently in design or prototype stages.

Laboratory For Electronics is building prototypes of its APN-105, a doppler auto-navigator comparable to the APN-67, which weighs about 130 lb. General Precision Laboratory recently received a contract from Martin to produce its APN-102 an 85-lb. doppler system that provides only ground speed and drift angle information. The British Marconi AD2300 doppler system weighs about 130 lb. (It was shown at the Arinc AEEC meeting.)

Ryan itself has a civil system under design, called the Model 107C, which provides APN-67 functions plus great circle course and distance to destination information. A stripped down version, called the Model 114, will provide only ground speed and drift angle. It weighs about 85 lb., Ryan says.

All of these systems employ similar doppler techniques, i.e. bouncing two or more radar beams off the terrain, measuring the doppler shift resulting from aircraft or missile motion (AW Feb. 4, p. 83).

The number of navigation services provided depends on the sophistication and complexity of the navigation computer used.

APN-67 Features

The 200 lb. APN-67 provides the following navigation information:

- **Ground speed.**
- **Drift angle.**
- **Present position,** in latitude and longitude.
- **Ground track and deviation** from desired course.
- **Distance traveled** along the ground.

With the addition of a 25 lb. great circle computer, the APN-67 can also

give the pilot his great-circle course and distance to his destination, or back to his base. For shorter range operations, a 12 lb. rhumb-line computer can be used.

The APN-67 includes ground-speed and drift-angle memory provisions which enables the navigation computer to operate in a dead-reckoning mode whenever there is a momentary loss of signal, for example, during aircraft maneuvers or when radio silence must be maintained over enemy territory. For military aircraft which may undergo almost continuous maneuvering, a 12 lb. wind memory computer can be added which provides more accurate dead reckoning.

Continuous-Wave

The APN-67, and its civil counterpart, employ continuous-wave (CW) techniques, an outgrowth of Ryan's early post-war work in developing a guidance system for its Firebird air-to-air missile. Initial APN-67 research was carried out by the Naval Research Laboratory. The APN-67 operates at a frequency of 13,500 mc. and radiates a power of about 900 watts. The system includes the following major elements:

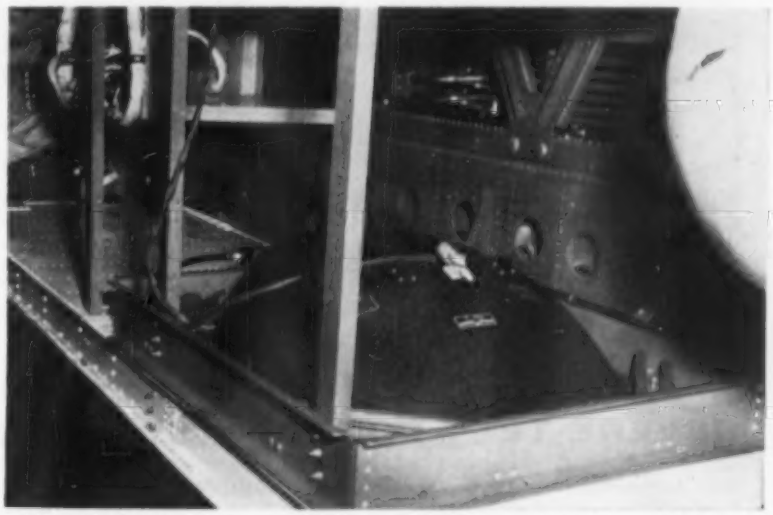
• **Receiver-Transmitter,** which includes an integral flush-mounted antenna and radome. The antenna reflector, a modified parabolic shape, is divided into two halves by a vertical partition (septum), one half used for transmission and the other for reception. Two feeds, one on either side of the antenna longitudinal centerline, illuminate the transmitting portion of the reflector to produce two beams, aimed aft, one on either side of the aircraft longitudinal centerline. Two co-linear feeds transmit reflected energy received from the ground to their respective microwave crystal detectors, where superhet techniques are used to produce an audio frequency signal corresponding to the doppler frequency shift. For the range of aircraft speeds at which the APN-67 is designed to work (80 to 800 kt.), this results in a doppler shift of 1 to 18 kc.

• **Signal Data Converter (SDC).** This is a dual-channel amplifier which employs narrow bandpass filters to locate and track the power-center frequency in the doppler shift spectrum, which corresponds roughly to the doppler shift that would be obtained if the radar beams were infinitely small in diameter. (In practice they are about 2½ to 3 deg. wide.) The SDC introduces an empirical compensation for the fact that the power-center frequency is not exactly the same as the beam center. Either of two different compensations can be selected by the pilot depending upon whether the aircraft is flying over land or water. The output of the signal data converter consists of two synchro signals,

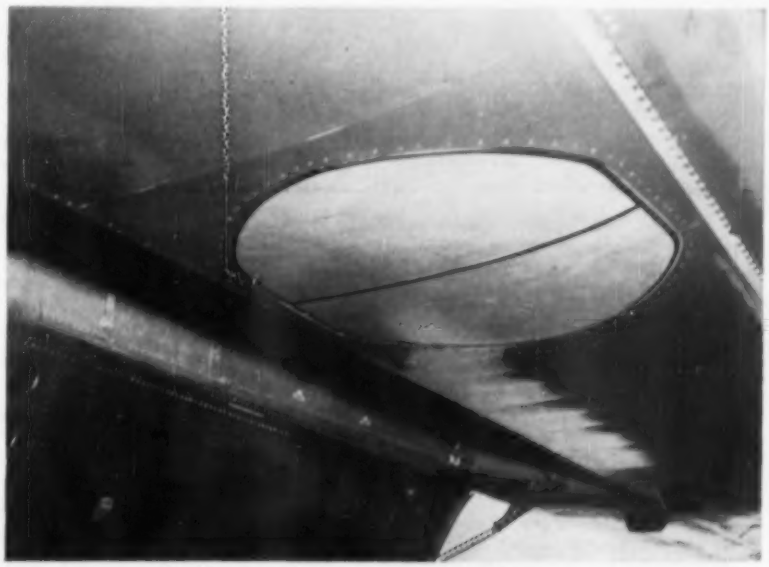
Doppler Who's Who

Following is a list of the 13 U.S. military doppler navigation systems recently declassified by the Defense Department and the equipment manufacturers:

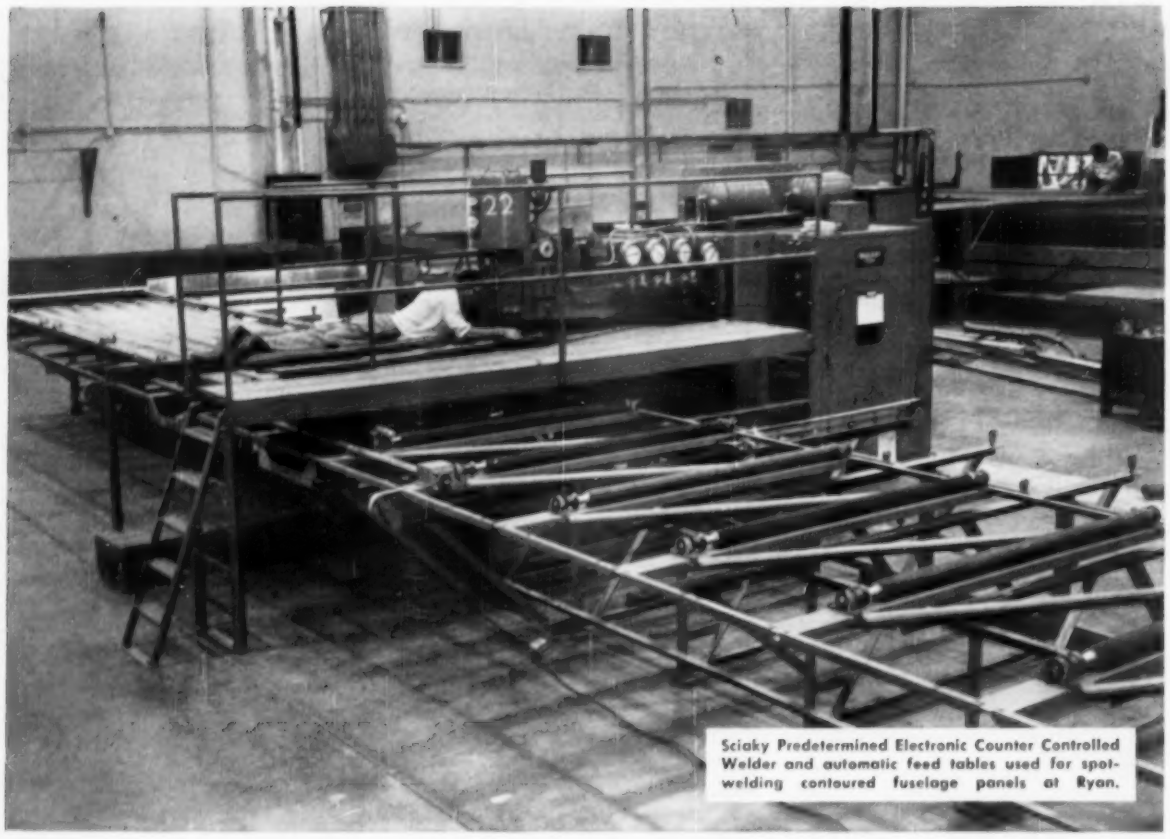
- **APN-66: General Precision Laboratory. (Auto-navigator.)**
- **APN-67: Ryan Aeronautical Co. (Auto-navigator.)**
- **APN-77: Sanders Associates.**
- **APN-78: Laboratory For Electronics.**
- **APN-79: General Electric. (Auto-navigator.)**
- **APN-81: General Precision Laboratory. (Ground speed, drift indicator only.)**
- **APN-82: General Precision Laboratory. (APN-81 plus Ford Instrument ASN-6 navigation computer.)**
- **APN-89: General Precision Laboratory. (Modified APN-81.)**
- **APN-96: General Precision Laboratory.**
- **APN-97: Ryan Aeronautical Co. (Helicopter version of APN-67.)**
- **APN-99: General Precision Laboratory. (APN-81 plus Ford Instrument ASN-7 navigation computer.)**
- **APN-102: General Precision Laboratory. (Ground speed, drift indicator only.)**
- **APN-105: Laboratory For Electronics. (Auto-navigator.)**



SMALL, lightweight receiver-transmitter, shown installed in A3D, is integral with . . .



FLUSH antenna and radome, divided into two sections for transmission and reception.



Sciaky Predetermined Electronic Counter Controlled Welder and automatic feed tables used for spot-welding contoured fuselage panels at Ryan.

COMPLEX SPOTWELDING PROGRAM AT RYAN IS SEVERE TEST FOR NEW SCIAKY COUNTER CONTROL

Ryan Aeronautical Company, San Diego, California has achieved a significant first in resistance welding—automatic spot welding of large contoured fuselage panels for the Boeing KC-135 and "707" Jets.

Referring to their new Sciaky Counter Controlled Welder, Mr. Bob Fullerton, Ryan's Senior Welding Engineer, stated, *"This is one new welding development that really does what the advance announcements promised."*

PRECISE CONTROL

Early in the program, it became obvious that precise control of all welder functions and absolute production consistency of welding was essential. Introduction of the new Predetermined Electronic Counter Controlled Welder by Sciaky helped solve this problem.

Here, for the first time, is a welder in which functions are controlled to a fraction of a cycle of alternating current. Control settings are realized with exactness. The unvarying accuracy of counting is maintained throughout the entire range for the longest run at the highest production rate. Any production control setting is readily reproducible at any time.

CONSISTENT, SAFE WELDS

The consistently safe welds produced by the Sciaky Counter Weld Control are essential to the Ryan program since the skin is a load-bearing member. In addition, the size of the assembly—largest every sub-contracted in the industry—will not tolerate even the possibility of rejects due to imperfect welds.

The importance of consistently perfect welds is emphasized by the tremendous number of spotwelds in the aft fuselage sections of the Boeing jet tanker-transports. Approximately 77,000 spot welds are required to join skins to skins, skins to doublers and stringers, and bulkhead components together.

TAPE COMMAND OF WELDING OPERATIONS

Welding operations on the various assemblies can be controlled by a tape command unit providing complete piece part positioning in all directions. Automatic interlock between positioner and welder is required. This would provide more automatic operation.

COMPLEX TOOL-UP

Handling and positioning the aluminum skins also presented a major problem. Ryan solved this by installing huge positioning tables with push button controls to permit automatic feeding.

The characteristics and consistent operation of the Sciaky Counter Controlled Welder combine perfectly with the automatic abilities and consistency of the Ryan positioning table to satisfy the requirements of this complex production assembling operation.

LITERATURE AVAILABLE

Technical bulletins completely describing the new Sciaky Predetermined Electronic Counter Weld Control are available. Write on your company letterhead requesting Bulletins 338 and 339.

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RYAN APN-67 employs continuous-wave techniques and two beams aimed aft.

one proportional to port beam doppler shift, the other to starboard beam shift.

• **Ground Miles & Drift Angle Computer (CMDA).** This electro-mechanical analog computer first compensates the port and starboard signals for aircraft pitch, roll and altitude changes which otherwise would introduce errors. The compensated doppler signals are then added vectorially to produce a signal proportional to aircraft ground speed along the direction of aircraft heading. Subtracting the two doppler signals produces a signal proportional to aircraft drift. The vector addition of the sum and difference signals is proportional to airplane ground track. These three output signals from the GMDA are used to actuate cockpit ground speed, drift angle and course deviation (from desired track) indicators as well as to provide inputs to an automatic navigation computer.

Two Computers

Ryan offers a choice of two types of navigation computers for use with the APN-67.

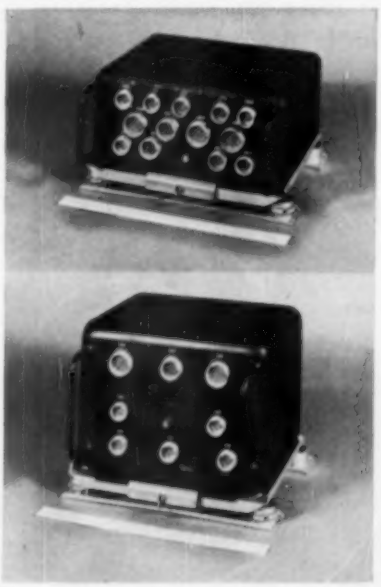
Both are electro-mechanical analog types.

• **Great-circle computer** continuously and automatically determines and indicates great circle course and distance to any desired destination or waypoint.

• **Rhumb-line computer** gives rhumb-line course and distance to destination, for fighter type aircraft which operate over shorter distances.

The great-circle computer includes built-in cam compensation for magnetic variation (difference between true and magnetic north) and compass errors (magnetic deviation).

The APN-67 analog computers were developed for Ryan by Kollsman Instrument. In the civil doppler auto-navigator, Ryan plans to use electric analog computation, employing resolvers and potentiometers to reduce computer weight and size, according to John Bowden, of Ryan's electronics engineering department. The Model 107C also will provide data stabilization for



TWO APN-67 analog computers. Unit above calculates present position and course deviation. Unit below computes distance traveled and drift angle.

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Set to move in the fall into its new home—the former City of Dallas airline terminal (immediate right)—SAC's distribution division is one of aviation's finest sales forces. VP Paul Kennedy, "head coach" of a fiercely loyal team, is shown in the inset photo presenting a service award to Bob Jackson, Midwest Division manager.
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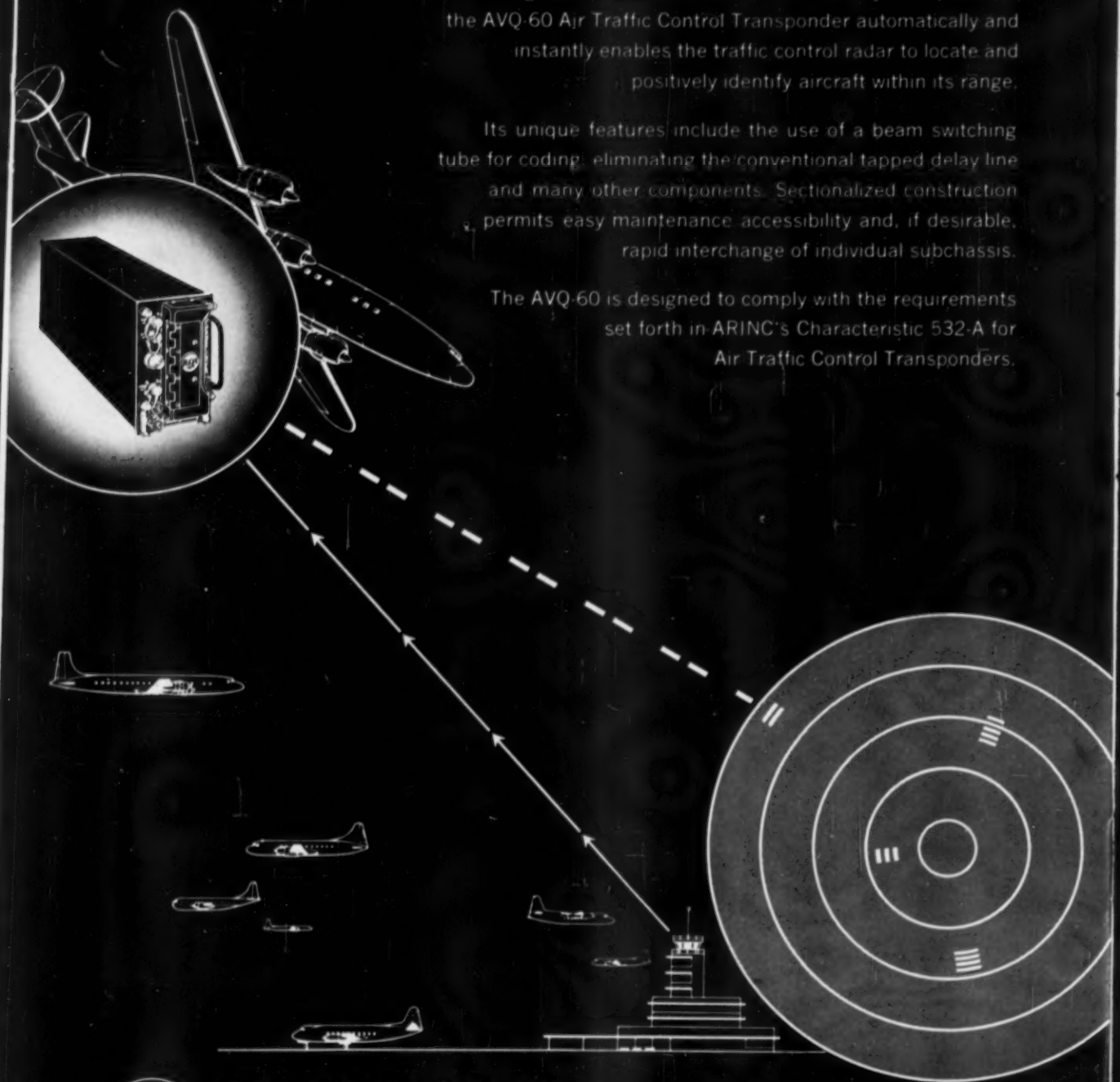
AVQ-60 AIR TRAFFIC CONTROL TRANSPONDER

Designed for airline, business, and military transport use, the AVQ-60 Air Traffic Control Transponder automatically and instantly enables the traffic control radar to locate and positively identify aircraft within its range.

Its unique features include the use of a beam switching tube for coding, eliminating the conventional tapped delay line and many other components. Sectionalized construction permits easy maintenance accessibility and, if desirable, rapid interchange of individual subchassis.

The AVQ-60 is designed to comply with the requirements set forth in ARINC's Characteristic 532-A for Air Traffic Control Transponders.



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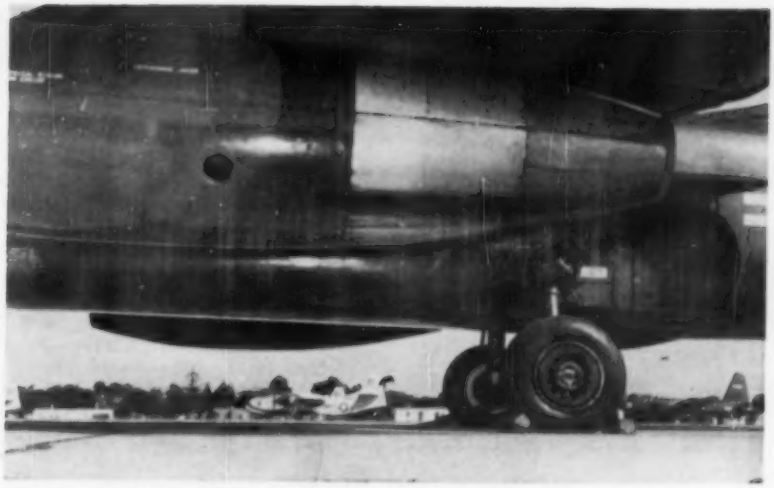


APN-67 flush antenna is flush in belly of A3D about two feet forward of wheels.

greater angles of aircraft pitch and roll than the APN-67, currently limited to about ±15 degrees.

CW vs. Pulse

Although there is general agreement that doppler auto-navigators are extremely valuable aids, there is a strong split over the relative merits of CW systems and pulse-type systems. Ryan is perhaps the foremost proponent of CW; General Precision Laboratory and Laboratory For Electronics are found in the pulse camp.

Here are some of the advantages that Ryan engineers cite for their CW approach:

- **Flush-mounted, non-rotating antennas.**
- **Less complexity** in system design.
- **Greater signal-to-noise ratio** at high altitudes. This is particularly important over smooth water where signal return is low. Tests run on the APN-67 at 40,000 ft., 450 kt. show a signal-to-noise ratio of 36 db. over land, 21 db. over sea water in Beaufort sea state 1 (relatively smooth), according to Bowden.
- **Lower power.** In a CW system the energy is concentrated in a narrow frequency band, not dispersed in a number of sidebands as in pulse-type systems, Bowden points out. Total power consumption of the APN-67 is less than 1 kw., Ryan says.
- **No "altitude hole" problem.** This phenomena, characteristic of pulse-type systems, occurs when a pulse of echo energy reaches receiver at the same instant as a pulse is being transmitted, causing loss of the received signal. Changing the pulse repetition frequency can reduce the effect, but adds equipment complexity.

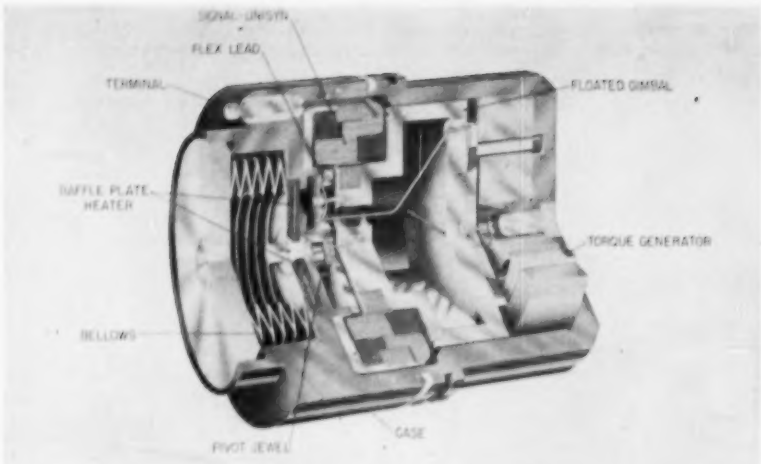
FILTER CENTER

▶ **Photo-electric IR Detector**—Photo-emitter type IR detector, reportedly sensitive out to a wavelength of six microns, has been developed by infrared section at Naval Air Development Center, Johnsville, Penna. Technical report on device will be ready soon for distribution to qualified government-industry representatives.

▶ **ICAO Plans Scatter Network**—Direct voice-teletype link between Europe and America, using three forward scatter radio stations and a new Atlantic cable, has been announced by International Civil Aviation Organization. Entire network is slated to be operational in 1960 and will provide one voice and

Missiles on Soviet Destroyer?

Two Soviet destroyers bound for Far East pass southward through Suez Canal. Aft director and deck installation of closer vessel resembles Terrier missile control installation of U. S. destroyers. Among radar antennas appearing on masts is S-band surveillance radar antenna similar to type used by U. S. with early SG radar. Egyptian Canal Authority officials quoted Russians as saying ships were en route from Sevastopol to Vladivostok.



MINIATURE PENDULOUS ACCELEROMETER

Integrating Accelerometer

Miniature integrating accelerometer, employing pendulous gyro principle, has threshold of 0.001 Gs, measures only 1.75 in. long by 1.75 in. diameter, weighs 0.4 lb. New integrating accelerometer, developed by Minneapolis-Honeywell's Aeronautical division, is companion to recently announced miniature integrating gyro (MIG).

four teletype channels. Scatter stations will be located at Narssaq, Greenland, Gander, and at Reykjavik, Iceland. Cable will connect Reykjavik with Prestwick, Scotland.

▶**M-H To Produce "Idiots"**—North American Aviation has licensed Minneapolis-Honeywell to manufacture the Instrumentation Digital On-line Transcriber (IDIOT) developed by its Rocketdyne division for recording 128 different temperature, pressure and/or strain readings simultaneously. System includes provision for conversion into binary code for automatic computer processing of the recorded data.

▶**Bell Landing System Check-out**—Navy will soon install improved version of the Bell Aircraft automatic landing system aboard an aircraft carrier for operational evaluation.

▶**Passive Radar Reconnaissance**—Rome Air Development Center has awarded contract to Stromberg-Carlson for development of ground-based reconnaissance system using new type radar techniques. Stromberg-Carlson subcontractors on program include Convair, Melpar and Pickard & Burns.

▶**PAA to Evaluate Synchronous Detection**—General Electric's synchronous detection technique will get an operational evaluation by Pan American Airways in the Pacific area to see if it can overcome frequent outages experienced with conventional AM in high frequency communications.

▶**New USAF Radar**—Bendix Radio will develop new air traffic control surveillance radar, with range of more than 100 miles, under $2.2 million contract received from Rome Air Development Center.

▶**Too Many Conventions?**—Increasing number of technical conventions and trade shows, and cost of exhibiting at such shows, has prompted Radio-Electronics-Television Manufacturers Assn. to send our survey questionnaire to its members. Object is to determine number, type, cost and desirability of shows which members must consider in their exhibit planning. Results will be announced later.

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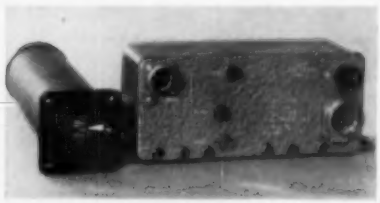

NI-10 Indicator

Miniature direct-reading temperature indicator, Type NI-10, self-balancing potentiometer type, uses moving tape display instead of pointed for greater accuracy. Developed by Douglas Aircraft Co. for flight test purposes, new device comes in two models, one covering temperature range of −100 to 600F, the other 300 to 900C. The Handley Electronics Co., Van Nuys, Calif. will produce new indicator under Douglas license.

Lockheed F-94C Starfire and the Hughes radar fire control system with which it is equipped.

Hughes has been the leader from the beginning in applying electronic computers to airborne fire control equipment. Today every U.S. Air Force and Canadian continental defense interceptor uses Hughes-developed and Hughes-manufactured systems.

Product Design at

HUGHES WEAPON SYSTEMS DEVELOPMENT LABORATORIES

As the intercept problem becomes more and more automatic, additional equipment such as new-type computers, control surface tie-in (CSTI), autopilots, and other units must be integrated into the system. Faster speed and heavier engines dictate more streamlining—and hence less space for electronic gear. The result is even more miniaturization and compact packaging, evolved from special techniques.

This all means that now the product design engineer is more important than ever before. In the Product Design Laboratory he is a vital part of the formal link between the Research and Development activity and the optimum configuration and installation arrangements for the systems "black boxes."

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ENGINEERS

to engage in the design and fabrication of airborne telemetering equipment for guided missiles.

ENGINEERS

to participate in development, design and prototype construction of electrical and electrohydraulic power supplies.

IN THE RADAR FIRE CONTROL AREA

ENGINEERS

to do equipment development and circuit design on special military field test equipment for support of fire control radar, fighter identification, and armament auxiliary equipment.

ENGINEERS

for circuit and equipment development in the field of airborne communication and navigation circuits.

ENGINEERS

experienced in computer or related fields to develop military field tests and auxiliary equipment for support of airborne computers.

You are invited to send resumes of your education and experience to the address at left.

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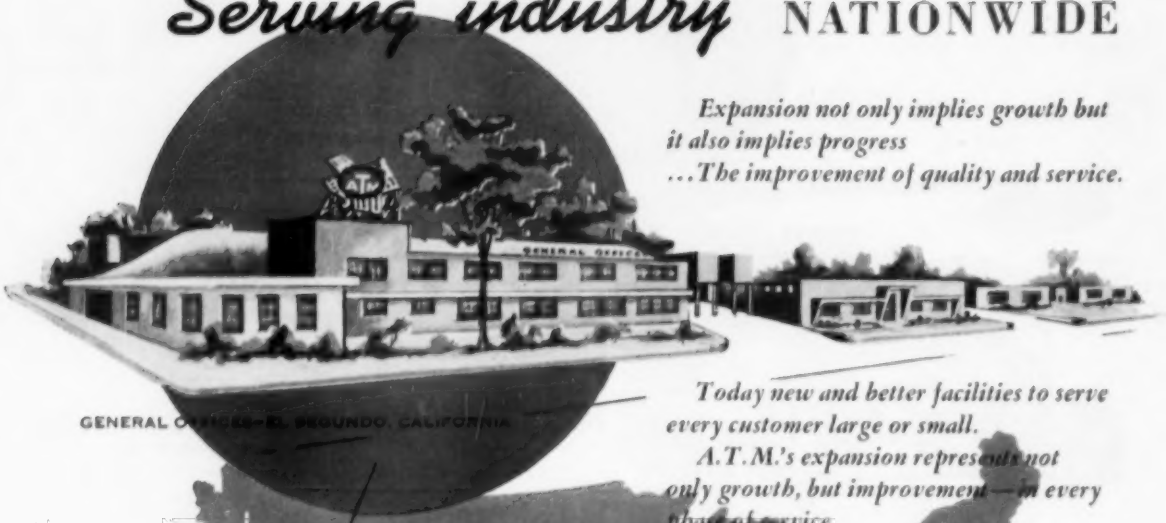

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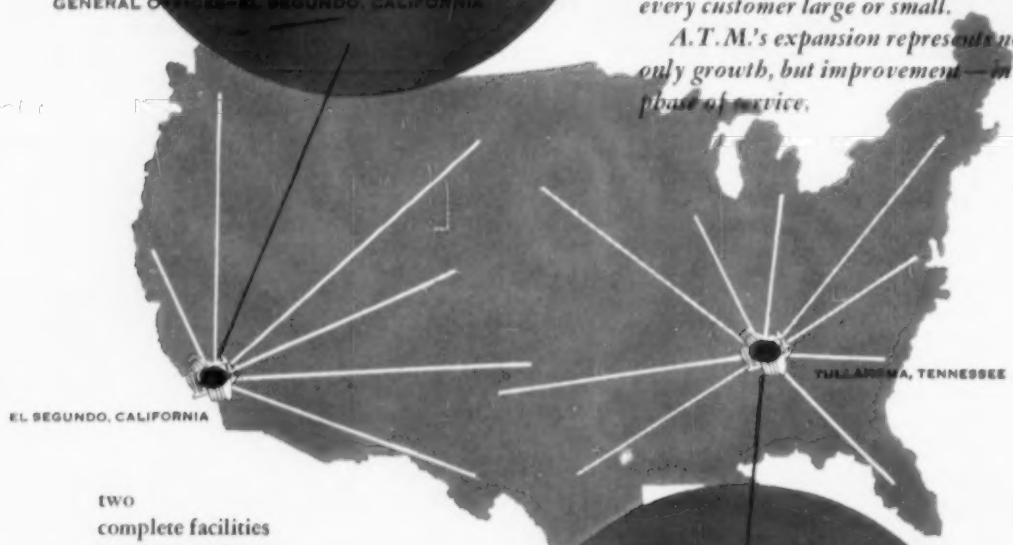

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TWA Begins Jetstream Service

Trans World Airlines has begun service to Europe with its new Lockheed 1649A Jetstream transports. This view from below shows enlarged inboard nacelles needed to house stronger landing gear necessary because of 1649's increased weight, 20,000 lb. more than previous version. First commercial all transistorized flight control system, Bendix PB-20B unit, was introduced on the airplane. Jetstream, which has increased wingspan and synchrophasing, and electronic device to keep all four propellers turning in the same specified angular relationship to reduce noise and vibration, will add more than 1,000 seats to Europe a week on TWA schedules. Transcontinental service also is being offered. TWA has switched from hollow to solid propeller blades (AW July 1, p. 41).

Expansions, Changes In Avionics Industry

Reeves Instrument Corp. has opened new $500,000 research and production facility at its Roosevelt Field, N. Y., plant. Facility is producing floated gyros and accelerometers to production tolerances of 10 millionths of an inch, company says.

Super-controlled laboratory has air filtration system which keeps out dust particles as small as 0.3 micron (12 millionths of an inch).

Other recently announced expansions and changes in the avionics industry include:

• **Hufford Corp.** and **Unitronics Corp.** will merge with **Siegler Corp.,** if stockholders approve, to become operating divisions. Unitronics is parent corporation for Olympic Radio & Television Co., Long Island City, N. Y. Hufford, El Segundo, Calif., makes stretch forming equipment. Siegler, with executive offices in Anaheim, Calif., is an electronic equipment manufacturer. Combined companies will be headed by John G. Brooks, president of Siegler, and are expected to gross more than $75 million annually.

• **Radio Corporation of America** will build 132,000 sq. ft. airborne systems laboratory near Bedford, Mass., on Route 128, to house operation now located at Waltham, Mass.

• **Sperry Rand Corp.** will build $2 million facility at Clearwater, Fla., for development and testing of microwave and electronic test equipment. New facility is slated to be in operation within a year, is expected to employ 150 scientific and technical people.

• **Universal Transistor Products Corp.** has moved to new larger facility at 36 Sylvester St., Westbury, L. I., N. Y.

New Welder

Component leads can be welded to printed circuit boards, metal-coated ceramics and other extremely thin metal surfaces using new Duo-Weld Electrode Accessory developed by Unitek Corp. for use with its Weldmatic stored-energy welders.

• **Leland Electric Co.,** division of American Machine & Foundry Co., has moved all engineering and sales personnel for aircraft products to new 140,000 sq. ft., $2.2 million plant in Vandalia, Ohio. Company expects to transfer all aircraft products manufacturing from Dayton to new Vandalia plant within next few months.

• **Stromberg-Carlson** has opened two new buildings, with one million sq. ft. of additional space, more than doubling previous Rochester facility.

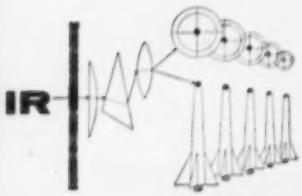
• **Airpax Products Co.** has opened engineering offices at new plant in suburb of Ft. Lauderdale, Fla. New plant, when completed this month, will include production facilities.

• **Minneapolis-Honeywell** has completed transfer of most of its inertial guidance engineering staff to new facility at St. Petersburg, Fla. Staff now numbers 300 and is slated to reach 500 by year-end.

• **Lockheed's Missile Systems Division,** Sunnyvale, Calif., is building facility for design and testing of advanced missile antennas and radar devices. Facility will include provisions for making reflectivity and antenna pattern measurements, a 20 x 70 ft. anechoic chamber, and a dielectrometer room for measuring dielectric constant of various materials.

• **General Precision Laboratory** has

INFRA-RED IS ULTRA-MODERN



In the post-war years, the development of infra-red devices has attained the dimensions of a technological breakthrough. In this period, the Electronics and Guidance Division of Aerojet-General Corp. has become the national leader in the development and manufacture of infra-red equipment.

Aerojet offers qualified engineers and scientists unparalleled opportunities in every area of the guidance and propulsion field.

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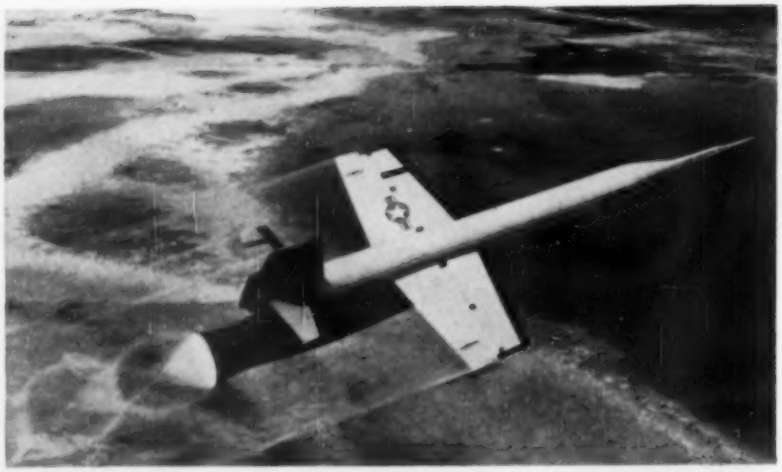


X-7 Command Station

Lockheed X-7, in composite photograph (above) over Holloman Air Development Center, Alamagordo, N. M., will be controlled from ground by new command station (below). Lighting, color and readability of instruments were arranged by team of experimental psychologists and engineers to increase operator's speed, lessen error. Example of result of two-year study of panel: three-dimensional miniature missile which indicated pitch and roll was changed to two dimensional flight indicator displaying pitch in degrees and roll with wing movement from horizontal line. Lockheed said that artist's representation of shock diamonds from Marquardt ramjet were accurate reproduction.

opened 23,200 sq. ft. environmental test building at Pleasantville, N. Y.

• **ElectroData Division of Burroughs Corp.** has completed enlargement of its Pasadena, Calif., plant, providing total floor space of 250,000 sq. ft.

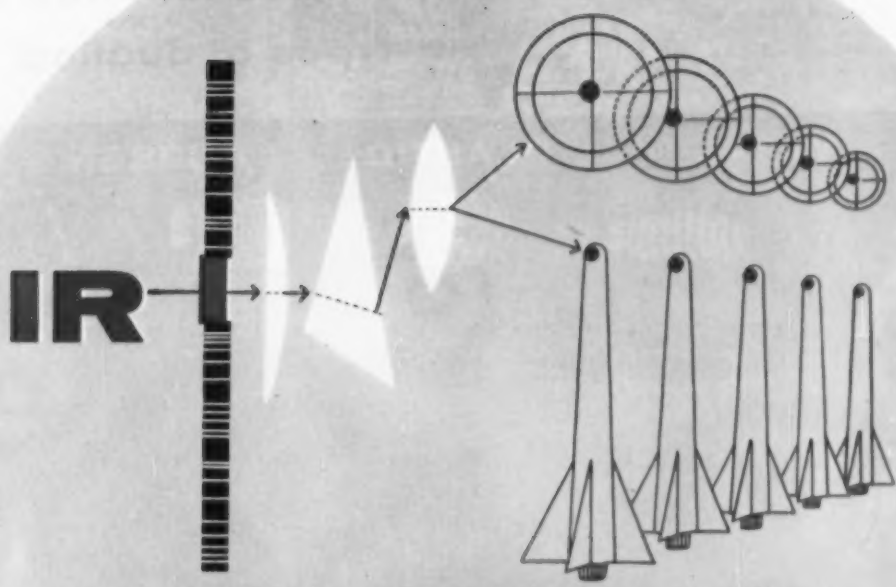
• **The Bristol Co.**, Waterbury, Conn., has opened new branch factory and repair laboratory at 6800 East Acco St. in Los Angeles, and a similar facility at 3617 West Alabama in Houston, Texas. Company also moved its Pittsburgh office to 2250 Noblestown Rd.

• **Consolidated Electrodynamics Corporation**, Pasadena, Cal., has established a new division to be called DataTape Division. It will specialize in engineering, design and manufacture of a standard instrument line of magnetic-tape recording and reproducing equipment.

NEW AVIONIC PRODUCTS

Components & Devices

• **Miniature floated rate gyro**, Model 55,000, is available with maximum rate of 1 to 1,000 degrees per second, employs inductive signal pick-off with high power output. Damping ratio reportedly



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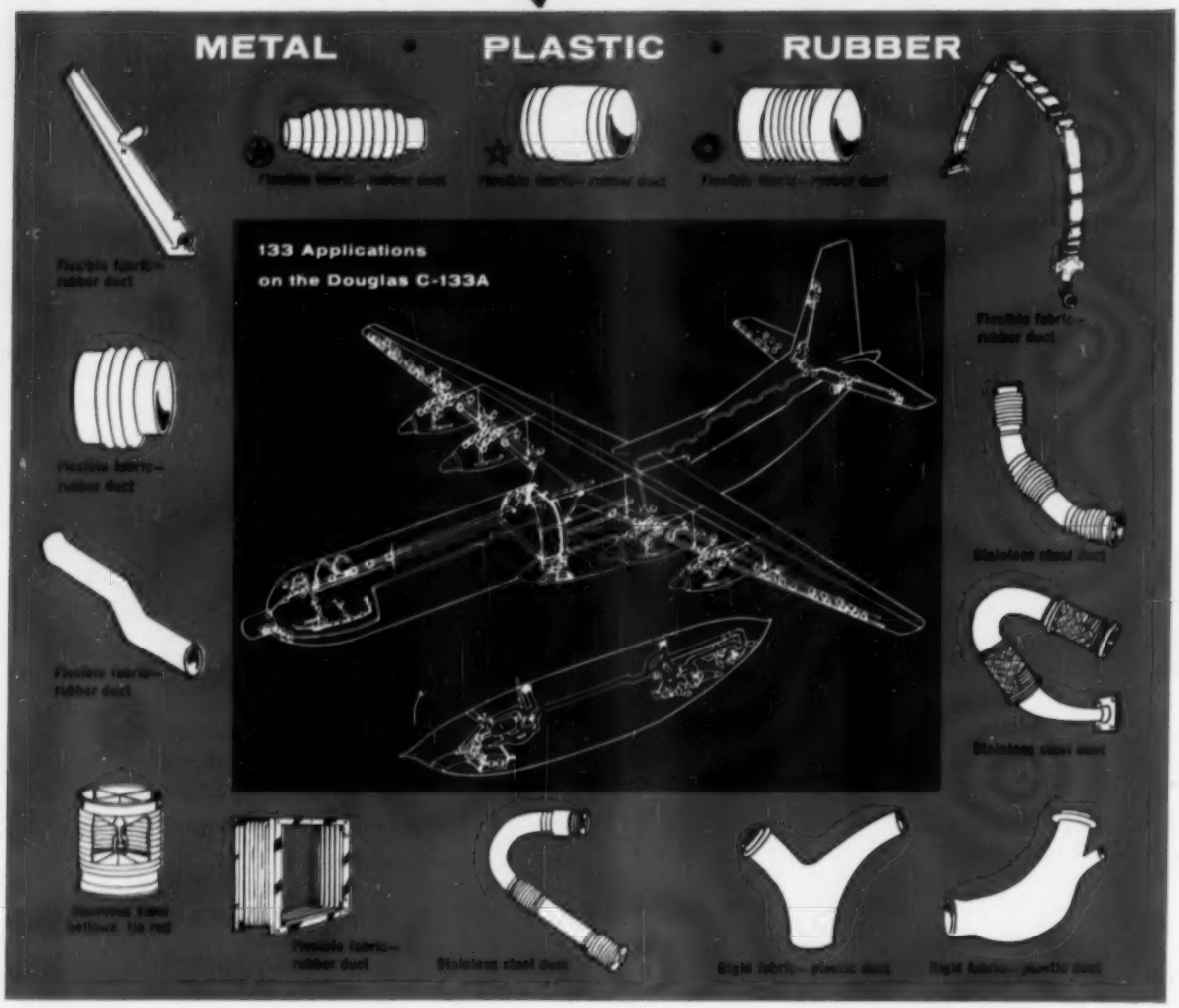

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is maintained within 0.1 over temperature range of −55C to 85C. Norden Ketay Corp., Commerce Road, Stamford, Conn.

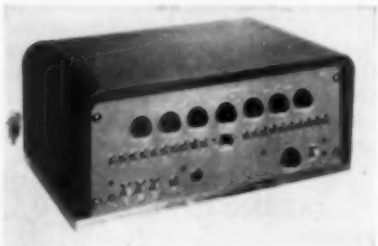
• **Miniature rate gyro,** Type GN, is available with full scale rates up to 600 degrees per second, with threshold and resolution of 0.01 degrees per second, suitable for operation at temperatures of −55C to 100C under 10G linear vibration from 0 to 2,000 cps and shock up to 100G. Gyro has variable reluctance pick-off with linearity of 0.1% to one-half full scale range, within 2% for full range. Unit measures 1 in. dia. x 2¼ in. long, weighs 3.8 oz. Minneapolis-Honeywell, Boston Div., 1400 Soldiers Field Road, Boston 35, Mass.

• **Precision single-turn potentiometer,** Model 130, designed to military specs, is available with standard linearity of 0.5% or better upon request. Unit has standard resistance range of 10 to 30,000 ohms, with standard tolerance of 3%. Temperature range is −55C to 85C. Life reportedly exceeds 1 million operations. Unit is available with number of taps or high temperature (150C) coils. Spectrol Electronics Div., Carrier Corp., 1704 South Del Mar Ave., San Gabriel, Calif.

Laboratory Equipment

• **Time-to-pulse-height converter,** Model TH-300, can measure time intervals in the range of 0.25 milli-microsecond to 1 microsecond, with resolution times in the order of 40 micro-microseconds. Instrument output is a pulse whose amplitude is proportional, within 1%, to time interval being measured. Readout can be accomplished by a multichannel pulse height analyzer or oscilloscope. El Dorado Electronics Co., 1401 Middle Harbor Rd., Oakland 20, Calif.

• **Dual Pultrator,** new type of test equipment, provides two pulse trains with variable spacing and duration times, for simulating radar returns from multiple targets or unsynchronized beacon replies. Device reportedly does the work of 20 single pulse generators of conventional type in cascade. Each train has 10 pulses with variable spacing and duration time. Any of the pulses may be omitted or added to the pulse trains



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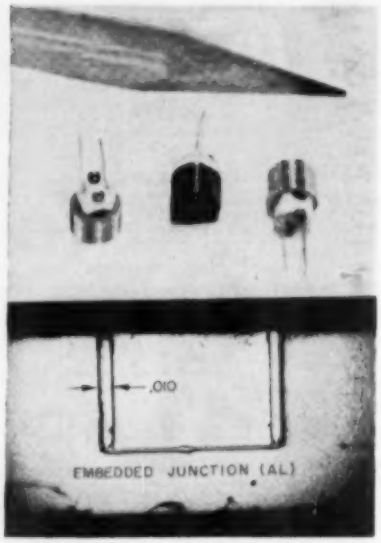
by means of selector switches. Pulses may be interlaced or positioned consecutively. Pulse width range is 0.3 to 0.6 microseconds; pulse spacing is 2 to 4 microseconds. Additional details are available from Packard-Bell Electronics Corp., Technical Products Div., 12333 West Olympic Blvd., Los Angeles.

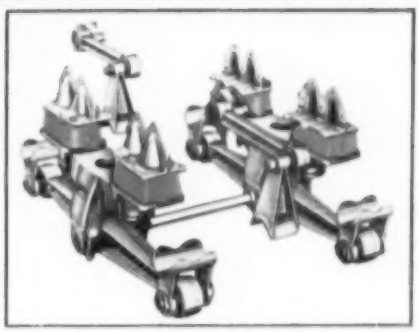
Instrumentation

• **Thermocouples,** called "Delta-Couples," designed to measure temperatures at in-wall locations, employ ribbon junctions embedded in "weld nuggets" at selected depths in the ¼ in. threaded



plugs of steel and aluminum. Units can be operated from −50 to 1,000F in steel plugs, up to melting point in aluminum plugs. Detroit Controls Corp., Redwood City, Calif.

• **Seven-channel a.c. amplifier,** linear within ¼ db. from 2 to 100,000 cps., provides voltage gains of 1.0 through 100, selectable in 11 steps without degradation of signal-to-noise ratio. Noise and hum are quoted at 50 microvolts or less referred to input over the 100 kc. bandwidth. Output voltage is 10 v. rms. into 50,000 ohms and 1,000 mmfd. capacitance in parallel. Accuracy is 2% at any gain setting. Dynamics Instrumentation Co., 1118 Mission St., South Pasadena, Calif.



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Send for Bulletin 30-L-5.

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2. *Produces components within strict dimensional limits*
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5. *Controlled blow is well suited to forming large integral parts*
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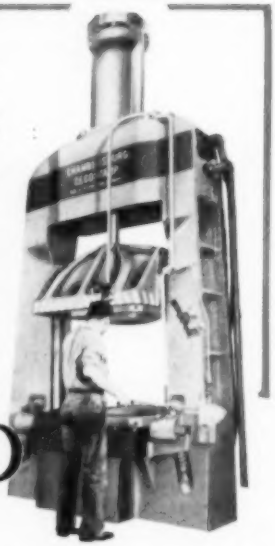

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SHOULDER-WING LAYOUT with enclosed cockpit is used on latest version of Goodyear Inflatoplane. Cockpit canopy hinges at nose. Powered by a 44-hp. engine, top speed is about 50 mph., range about 400 mi. It can be inflated by household vacuum cleaner.

Cost Tempers Rubber Planes' Civil Hope

Improvements in rubber aircraft designs here and in England are shown in the latest configurations revealed by Goodyear Aircraft Corp. and M. L. Utility Aircraft, Ltd. Planned originally for military applications, both aircraft are seen by their manufacturers as having potential development into low-cost lightplanes for pleasure flyers.

If such interest should develop, prices obviously would have to be scaled down from those presently mentioned. A Goodyear representative estimated that price of that company's GA-447 Inflatoplane would be approximately $5,000 in large quantities, considerably above what most purely pleasure pilots would probably want to spend for a type of such limited utility.

Goodyear currently is building 10 Inflatoplanes under contract to Office of Naval Research, which will evaluate

LATER TWO-PLACE MODEL of Inflatoplane will seat two side-by-side, have a more powerful engine to improve performance. Project is being financed jointly by Navy and Army.

DELTA-WING INFLATABLE PLANE being tested by British features single stick for three-axis control. Fabric-covered nacelle (right) seats two in tandem, mounts 65 hp. pusher engine derated to 38.5 hp. When collapsed, wing section is stowed in nacelle.

How to make the most of your engineering career

ONE OF A SERIES

go where engineers don't get lost in the crowd

One of the many hurdles that can slow down your progress as an engineer is getting lost in the crowd. It can happen in smaller companies as well as in big ones.

That's because size itself is not the villain. The thing to watch out for is the kind of company organization that swallows you up and erases your individual identity.

Boeing is one company that takes steps to see that engineers *don't* get lost in the shuffle. Boeing engineers, for instance, work in small integrated teams where initiative and ability get plenty of visibility. Each engineer gets a personal merit review every six months—assuring you a continuing opportunity for individual recognition. In addition, Boeing engineers are eligible for advancement at any time between reviews. There are many other advantages to careers at Boeing—including assignment to exciting missile and jet-age projects, high starting salaries, liberal retirement and company-paid graduate study programs.

There are *family* advantages, too. One is a choice of three sections of the country in which to live. In each Boeing community you'll find good housing and schools, a youthful spirit, and abundant recreational facilities for the whole family.

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Mail this coupon to the address above from which you desire further information about the advantages of a career with Boeing.

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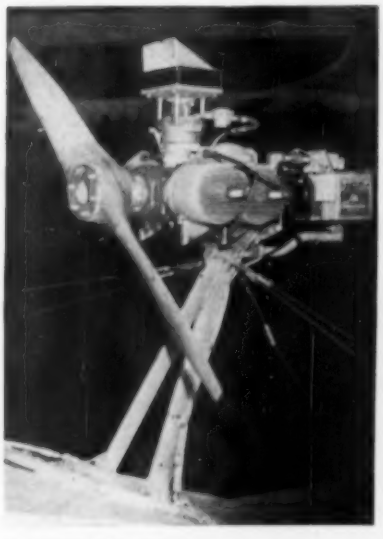
GOODYEAR COCKPIT (top) with canopy hinged upward, shows rubber rudder pedals, on floor ahead of stick, which slip over shoes. Nelson engine (uncowled) can drive a compressor to keep fabric inflated to proper pressure.



the aircraft's application as a rescue vehicle. The company has a two-place version of the single-seat GA-447 under development for ONR and Army.

The new airplane differs from earlier Inflatoplanes in configuration and construction. It is a shoulder-wing layout compared to the earlier parasol model. Construction is entirely of rubberized nylon, trade named Airmat, the airfoil preshaped while the cloth is manufactured in the mills. Joining the interior surface is a weave of countless nylon threads forming an I-beam load carrying structure when the aircraft is inflated. Inflation takes eight pounds/square inch pressure. Even the rudder pedals are rubber. •

Approximately the weight "of a man," the new GA-447 is designed for dropping from wing pods, bomb-bays or cargo hatches to crews of downed aircraft on land or in the water. Amphibious characteristics of the Inflatoplane are being evaluated.

Inflatoplane has a wingspan and length of approximately 34 ft. Powered by a 44-hp. Nelson H-59A engine, Inflatoplane's top speed is about 50 mph. and design range is approximately 400 mi. Takeoff and landing can be accomplished within 200 ft.

M. L. Utility Aircraft rubber airplane features a revised control system using a single hanging stick operating two surfaces on the delta wing for longitudinal, lateral and directional control. Rudder pedals are used only for working the steerable nose wheel.

The thick wing has an NACA 0024 airfoil. Suspended from it is the two-place tandem control car built up of a simple wood framework, fabric covered.

Rigidity of the wing is maintained by connecting upper and lower surfaces with a series of porous rubber diaphragms running spanwise; bending loads are taken by nylon lines from the wing to the nacelle.

Fuel tanks, of 7.2 U. S. gal. capacity each, are strapped under each side of

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PROTECTS CONTROLS OF THE SUPER SABRE

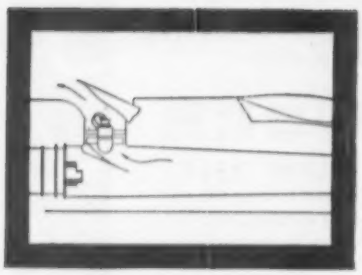
Aeroproducts air-driven hydraulic pump

in North American F-100D produces emergency power for flight controls

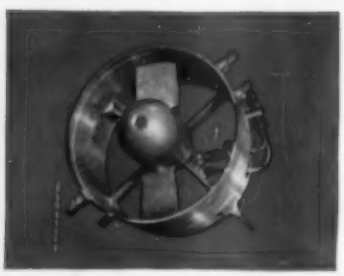
The Aeroproducts ram air-drive pump, mounted behind the cockpit of the USAF F-100D Super Sabre, produces sufficient hydraulic pressure for flight controls in case of either engine or hydraulic failure.

This compact, lightweight unit is another good example of Aeroproducts' extensive experience in designing and building essential aircraft components to meet specific customer requirements.

Our background includes pioneer development of Turbo-Propellers, plus advanced designs of linear and rotary actuators for airplanes and missiles.



Lightweight ram air pump is mounted behind cockpit. In emergencies, air from engine inlet ducts can be diverted by the pilot to drive the turbine-pump.



Weighing only 15½ pounds, the Aeroproducts ram air pump produces sufficient hydraulic pressure for flight controls in case of either engine or hydraulic failure.

If you're on a team designing a new airplane, missile or power plant, you'll find Aeroproducts ready to work with you on designs for actuators, pumps, generators and other accessories. Write us on your company letterhead for brochures: "Aeroproducts Ram Air Accessories," and "Actuators for Aircraft."

Building for today...Designing for tomorrow

Aeroproducts

GM AIRCRAFT POWER

ALLISON DIVISION OF
GENERAL MOTORS • Dayton, Ohio

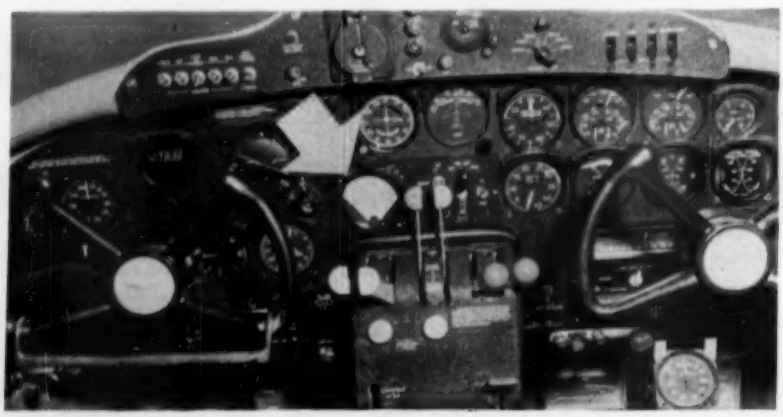
MORANE-SAULNIER MS-750 PARIS four-place twin jet has been ordered by several foreign government officials as a highspeed executive transport. Beech has option to build it under license in U. S., is awaiting sufficient interest to warrant production here.

Latest Foreign Lightplanes at Paris Air Show

FIAT-NARDI F.N.333 (left) three-place amphibian shown at Le Bourget Airport has a 240-hp. Continental engine. Landing gear and wingtip floats are retractable. Visitor from Czechoslovakia (right) was Avia L-60 short-field agricultural/utility airplane. West Germans showed Fischer two-place power glider with Porsche engine. Propeller is in split fin.

Light Radar for Light Twin

One of first installations of lightweight weather radar to a modern light twin business transport is this RCA AVQ-50 set on Reading Aviation Service's Aero Commander Super 680 demonstrator. Total weight of installation is 85 lb. Nose was reworked to take antenna and McMillan radome; a panel opens atop nose for access to transmitter/receiver unit. Three-inch radarscope is mounted on instrument panel (arrow, bottom photo).



the wing after inflation, feed a 65-hp. Walter Mikron four-cylinder pusher engine derated to 38.5 hp. Problem of cooling the engine has been the prime factor in derating it.

Gross weight is 1,000 lb. and empty weight is 515 lb. Takeoff run is 270 ft. when fully loaded and the range at 45-50 mph. is approximately 125 mi. For transportation, the entire assembly can be rolled up and packed into the nacelle, which is then towable behind a small car.

Cessna 310B Changes Are Largely Internal

Considerably redesigned interior is featured in new Cessna 310B light twin-engine business plane aimed at improving pilot effectiveness, passenger comfort and increasing the plane's useful load. Powerplants remain the same: two 240-hp. Continental O470-M. Plane is priced at $59,950, Wichita, approximately $500 higher than the last model.

Revised instrument panel has improved shielding to cut windshield glare and equipment has been relocated for greater convenience; radio and navigation gear and controls being moved to the center of the panel for easy access from either seat. Design is aimed at increasing effectiveness of two-man operation during instrument en route and approach conditions.

New instrument lighting system uses post-type red lights throughout which can be controlled by rheostats to provide individually suited brilliancy in each of the four zones.

Larger overhead lighting console for red and white light illumination includes an additional, fifth outlet for the plane's oxygen manifold. An optional oxygen system package is designed to allow filling the cylinder without removing it from the airplane.

Mixture control quadrant now has index markings for easier adjustment and there are three times as many adjustment notches in the mixture control linkage than previously to allow more accurate leaning. Other additions include a fuel filter bypass and auxiliary fuel gages on the instrument panel.

Lear ADF-12E and Aircraft Radio Corp ADF-21 are both offered as optional equipment on the 310B and a smaller Safe-Flight speed indicator is available as a deck-mounted unit.

Lower interior sound levels have been achieved by increasing windshield and cabin window thickness to one-quarter inch and an additional 21 lb. of soundproofing material has been installed. This is placed in the entire cabin structure, especially in the fore and aft limits, wing roots, rear baggage wall

40 years
and
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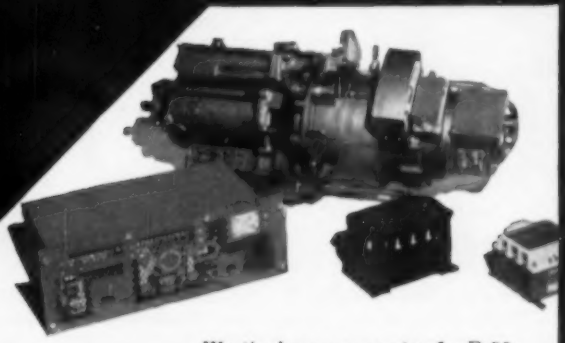
later...

USAF B-58 "Hustler", America's first supersonic bomber, Convair Division, General Dynamics Corp., Fort Worth, Tex.



Westinghouse apparatus for B-58: (1) Sundstrand Constant-Speed Drive and Westinghouse 40-KVA Brushless Oil-cooled Generator, (2) Regulator-Control Panel, (3) Transfer-Contactor, (4) Current Transformer Assembly.

First airborne generator, shown on Billy Mitchell's Spad 16. Photo: Courtesy of The Smithsonian Institution, Washington, D.C.

Westinghouse is still the leader in airborne electrical power!

From the single-blade, wind-driven Westinghouse generator above, shown on Billy Mitchell's Spad 16, to the amazing electrical components of Convair's supersonic B-58 "Hustler", is an epoch in air power.

And it's an epoch Westinghouse helped pioneer with *1,060,744 KVA of service* to the aviation industry.

For Westinghouse and the aviation industry have been partners in progress since 1917. The first airborne a-c generator, the multi-generator parallel a-c system and today's fully protected automatic system are just a few of the milestones.

The facilities of the Aircraft Equipment Department, at Lima, Ohio, have been at the disposal of the aviation industry for years. They're at *your* disposal, too. Why not use them?

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SAVED $220.63 EACH

A ring originally designed as a casting weighed 390 lbs. and cost $280.00. Later it was purchased from Amweld, as a rolled and flash-welded ring made from a contoured mill-rolled shape. More than triple savings resulted. Basic cost dropped to $59.37 and weight was reduced to 94.5 lbs. In addition, considerable time and money were saved in the finished machining operation.

Switching to Flash Butt-Welding of Mill-Rolled Sections Slashed Production Cost 76½%

SAVED $103.46 PER RING

Rough rings purchased by a well-known manufacturer of jet aircraft engines weighed 135 lbs. each. Most of this weight was excess metal which had to be machined away. American Welding's Industrial Products Division, working with this company, studied the product and recommended a flash butt-welded ring, formed from a special mill-rolled shape. Adopting this new ring saved 88 lbs. of metal and eliminated much of the machining time required.

American Welding can help cut costs in your plant by suggesting the use of rings rolled and flash welded from mill-rolled or extruded shapes.

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Contact the Industrial Products Division of The American Welding & Manufacturing Company. We will be glad to show you more actual cases of cost savings.

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USAF Gets Glider for Air Academy

Air Force will inaugurate soaring training as a scheduled part of the cadet curriculum at its academy at Denver, Colo., this summer using new Schweizer 2-22A trainer (left, rear) and 1-26B high-performance sailplane (right, foreground) shown in USAF markings. The 1-26B is fully equipped with oxygen for high-altitude work and two-way radio. Equipment will be used to familiarize USAF students at the academy with basic flight principles. Gliding has been a part of academy activity on a private club basis since last summer when a group of officers purchased a 2-22 and formed the Falcon Soaring Club to introduce a limited number of students to this form of flight. The club will continue as an extra-curricular activity.

and on the baggage door. Bulkhead lightening holes, bend reliefs for all fore and aft system routing, control cable routing holes and other small openings are also sealed with leather.

Revised three-passenger rear seat reclines two inches further and has removable armrests. Cessna is also offering double individual airline-type rear seats as optional equipment; by removing the armrest between the chairs, they can seat three.

Another major cabin change is a Stewart-Warner heater with 35,000 Btu. output, 15,000 Btu. higher than previously used. Larger air ducts and change in direction of airflow from front to rear has been incorporated. Baggage area is increased to 19 cu. ft. of usable area by recessing the rear cabin wall five inches.

Cabin access has been made more convenient with addition of a two-step retractable strut.

Increase in maximum gross takeoff weight to 4,700 lb., 100 lb. higher than previous models, gives a useful load of 1,735 lb. Maximum landing weight remains at 4,600 lb. Maximum top speed at sea level at the new gross weight is 232 mph.; 234 mph. at 4,400 lb. and 236 at 4,100 lb. Maximum recommended cruise at 70% power at 8,000 ft. is 213 mph. at 4,700 lb.; 215 at 4,400 lb. and 218 at 4,100. Range at maximum recommended cruise speed at 8,000 ft. with 130 gal. (with auxiliary internal tankage) is 1,107 at maximum gross weight, 1,118 mi. at 4,400 lb. and 1,136 mi. at 4,100 lb.

PRIVATE LINES

Piper Comanche four-place low-wing business plane received Civil Aeronautics Administration type certification. Piper will keep first eight airplanes for use by its sales department as demonstrators and for accelerated service testing; company's distributors will probably get their initial airplanes sometime in September.

Certification program of new Tactair T-2 lightweight autopilot installation on Piper Apache light twin is expected to start soon. Unit is priced at about $2,400, is approved for a number of single-engine business planes.

Beech will pay a 30 cents dividend July 22 to stockholders as of July 11. . . . Company has completed second production model Travel Air light twin and is fabricating number three ship.

Truck service supplying aircraft parts to all airports in 25-mi. radius of Philadelphia, Pa., is in effect by Central Aero Supply, Inc., twice weekly. Airports were formerly serviced by flying salesmen, who will now be free to cover new, more distant points.

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to join a small but heavyweight group doing some of the most stimulating work in rocket engineering.

If you are an experienced rocket engineer, well grounded in the realities of design, development, and application of advanced propulsion systems, there is a special opportunity for you in our Preliminary Analysis Group right now.

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As a Senior Research Engineer with this group, you'll contact customers, working with them on their requirements, guiding them on applications. You will plan the approaches and organize the means to solve problems inherent in the over-all development of highly advanced propulsion systems. You'll be gaining experience in such fields as new and improved propellents . . . relative merits of different systems . . . selection of over-all engine systems, parameters and principal components. *You* can help point the way to the development of the world's most powerful engines.

Write and tell us about your background: Mr. A. W. Jamieson, Engineering Personnel Dept. W-7, 6633 Canoga Avenue, Canoga Park, California.

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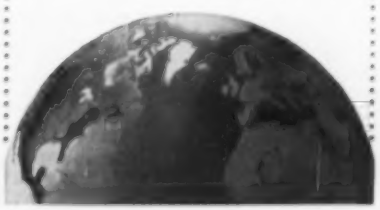
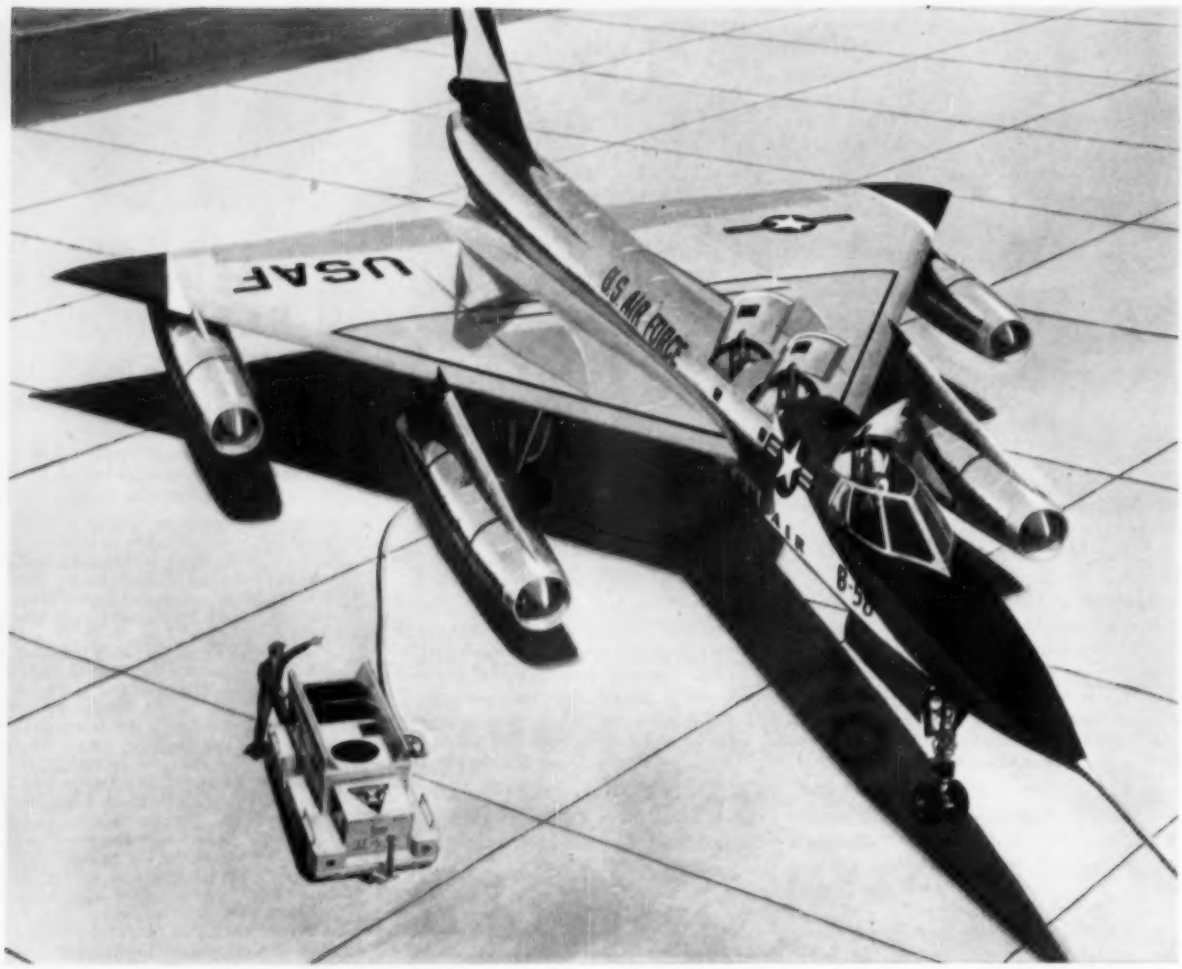
BUILDERS OF POWER FOR OUTER SPACE





Solar Advanced Technology

Gas turbine ground support unit starts giant jets in seconds

ADVANCED JET BOMBERS, like this Convair B-58 Hustler, require a powerful source of compressed air to start their high-thrust engines. Solar advanced technology has helped solve this aviation problem with mobile, portable gas turbine units that supply large volumes of compressed air as well as shaft power for electric and hydraulic adaptations.

The new unit, powered by a Solar 500 hp Jupiter® engine, offers many advantages over conventional ground support units. It is portable and lightweight, easy to maintain, starts instantly under severe temperature extremes and can be operated on a variety of fuels.

In addition to aircraft ground support, Solar gas turbines can be used for emergency and auxiliary power generation, pumping and mechanical drive, boat propulsion and many other applications requiring a compact, efficient source of power. For more information write to Dept. D-52, Solar Aircraft Company, San Diego 12, California.

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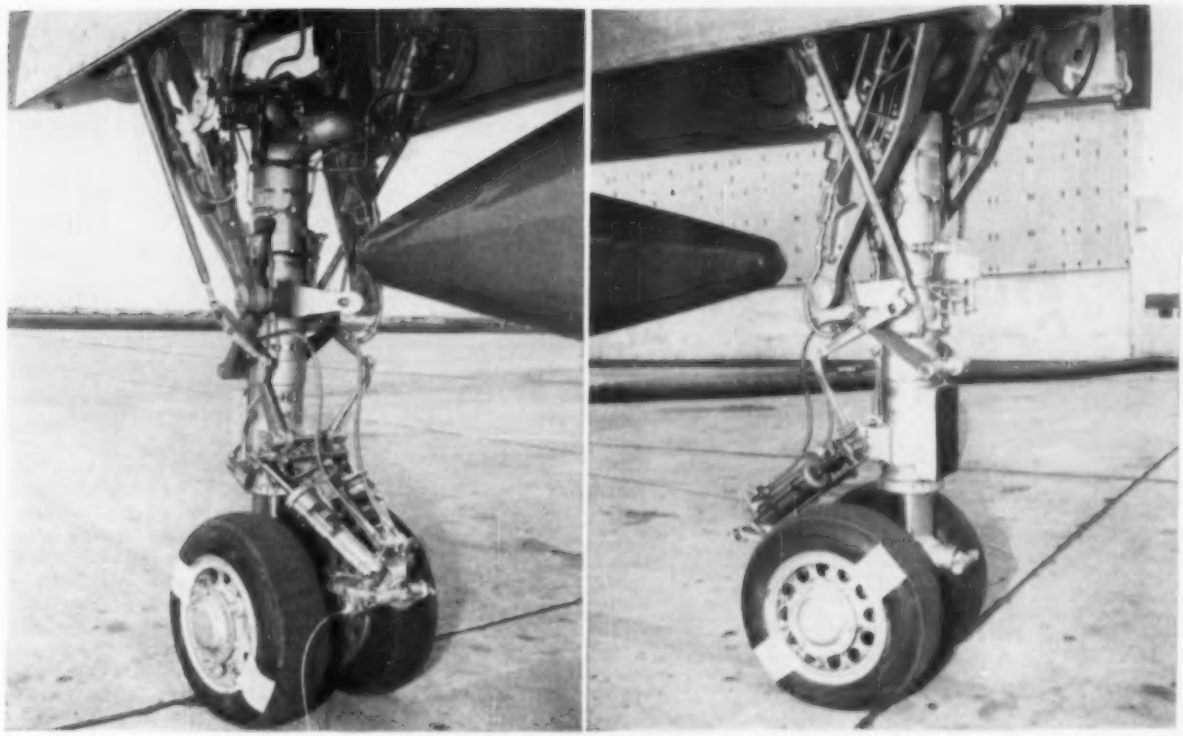


Hustler's Complex Nose Gear

These first pictures of the nose landing gear of Convair's supersonic B-58 Hustler bomber show complexity which had to be used to clear the nose of the plane's weapons pod. Linkage configuration suggests that the top of the shock strut folds aft around main pivot points just ahead of the pod's nose. As this occurs, entire structure moves up and back on main braces to either side of the shock strut, allowing dual nose wheels to retract in an almost vertical manner to clear the pod. Lines to the two nose wheel steering cylinders mounted directly above wheels and behind shock strut are 3,000 psi. high pressure high temperature teflon tubing, reinforced with double wire braid and supplied by Resistoflex Corp. under designation R700 (AW April 15, p. 91).

CAA Contracts

Following is a list of contracts as released by the Civil Aeronautics Administration:

Telefunken, Geschaftsberich Anlagen, West Germany, $988,800 for three airport surveillance radar units.

York Division, Borg-Warner Corp., York, Pa., $376,093.06 for 504 air conditioning units.

Collins Radio Co., Dallas, $259,689 for 38 microwave towers, 54 passive reflectors and other equipment for use with micro-wave link installations.

Circle Wire and Cable Corp., Maspeth, N. Y., $149,269.56 for power cable.

Bird Electronic Corp., Cleveland, $63,288.06 for 551 RF wattmeters and associated accessories.

Collins Radio Co., Dallas, $29,218.16 for eight VFH transmitters, receivers and spare parts.

Ferris Instrument Co., Boonton, N. J., $1,474 for signal generators and spare parts.

Wind Turbine Co., West Chester, Pa., $4,956 for Rhombic receiving antennas and transmission lines.

Westinghouse Electric Corp., Washington, $973 for one airport lighting control panel.

USAF Contracts

Following is a list of unclassified contracts for $25,000 and over as released by Air Force contracting offices:

TOPEKA AFD, TOPEKA AIR FORCE STATION, Topeka, Kans.

Aluminum Co. of America, 1200 Ring Bldg., Washington 6, D. C. Aluminum alloy sheet, 273,300 lb. (IFB 14-604-57-695), $259,754.

Aluminum Co. of America, 1200 Ring Bldg., Washington 6, D. C. Aluminum alloy sheet, 116,000 lb. (IFB 14-604-57-695), $126,602.

Air Logistics Corp., 3600 E. Foothill Blvd., Pasadena, Calif. Mobile jet engine run-up and test system—1 ea. (RFP 14-604-57-5474) $62,132.

General Motors Corp., Allison Div. Plant 5, Indianapolis, Ind. Six items of special tools and equipment for J-33 jet turbo engines for F-80 aircraft—39 ea. (RFP 15-604-57-5283) $72,056.

OKLAHOMA CITY AIR MATERIEL AREA, Tinker AFB, Okla.

Borg-Warner Corp., Pesco Products Div., Bedford, Ohio. Overhaul and modification of fuel booster pumps (OC 906017), 1 item, $48,000.

Parker Aircraft Co., Los Angeles, Calif. Valve & technical data (OV 706228) & (OC-706131), 3 items, $184,874.

Lockheed Aircraft Corp., Ga. Div., Marietta, Ga. Modification of B-47 type aircraft, (OC-730543-C1), job, $450,771.

Army Contracts

Following is a list of unclassified contracts of $25,000 and over as released by Army contracting offices:

CORPS OF ENGINEERS, U. S. ARMY, Jacksonville District, 575 Riverside Ave., Jacksonville, Fla.

J. C. Harper Construction Co., 960 Orange Ave., Winter Park, Fla. Construction of G/M instrumentation bldg. (addition to central control bldg.) Air Force Missile Test Center, Patrick AFB, Fla., job, ENG-08-123 (NEG-57-44) $222,000.

Herrick L. Johnston, Inc., 540 W. Poplar Ave., Columbus 8, Ohio. Furnishing nitrogen vaporizers for compressor bldg., Nos. 15 & 19, Cape Canaveral Aux. AFB, Fla., job, ENG-08-123 (NEG-57-40), $29,000.

CORPS OF ENGINEERS, New England Div., 150 Causeway St., Boston 15, Mass.

MSA Research Corp., Callery, Pa., design, fabricate and deliver one oxide control and indication unit for the Connecticut Aircraft Nuclear Engine Lab., Middletown, Conn., (IFB DA-19-016-ENG-5210, job, $61,085.

C. S. Flagg & Co., Inc., 48 Elm St., Meriden, Conn., construction of liquid fuel storage facilities for Bradley Field, Windsor Locks, Conn., (IFB ENG-19-016-57-135B), job, $100,900.

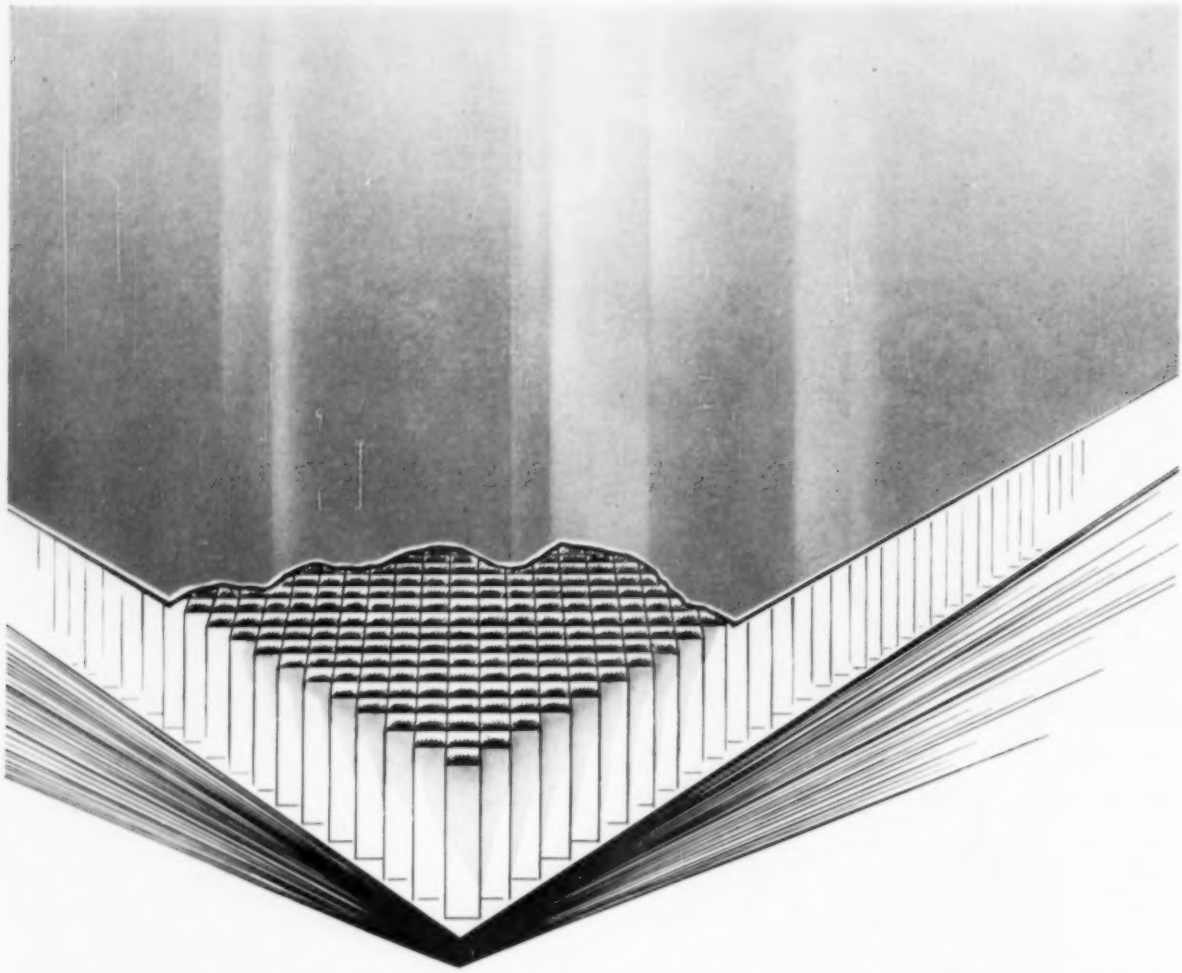
F. D. Rich Co., Inc., 550 Summer St., Stamford, Conn., construction of maintenance hangar & facilities and base supply warehouse for Bradley Field, Windsor Locks, Conn., (IFB ENG-19-016-57-62B), job, $1,714,400.

Merry Contracting Service, Franklin St., Duxberry, Mass., repairs to Dike, Long Beach, Plymouth, Mass., (IFB CIVENG-19-016-57-208), job, $49,800 (est).

CORPS OF ENGINEERS, Mobile District, 2301 Grant St., Mobile, Ala.

Southern Construction Co., Augusta, Ga., construction of airmen's dormitories at Columbus AFB, Miss., (IFB ENG-01-076-57-34), job, $1,144,653.

Banks, Ellett & Ramsey, Inc., Birmingham, Ala., modification of air conditioning for Building No. 412 at Redstone Arsenal, Ala., (IFB ENG-01-076-NEG 57-12), job, $63,955.



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Rohr is the acknowledged leader in the production of high-temperature structures. For instance brazed stainless steel honeycomb sandwich panel structure — result of a full-scale research program launched at Rohr several years ago. Today, with special Rohr-built equipment, we are working with most of America's leading aircraft manufacturers developing and manufacturing high-temperature structures for flight in the years ahead.

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PLANTS IN CHULA VISTA, RIVERSIDE, CALIFORNIA • WINDER, GEORGIA • AUBURN, WASHINGTON

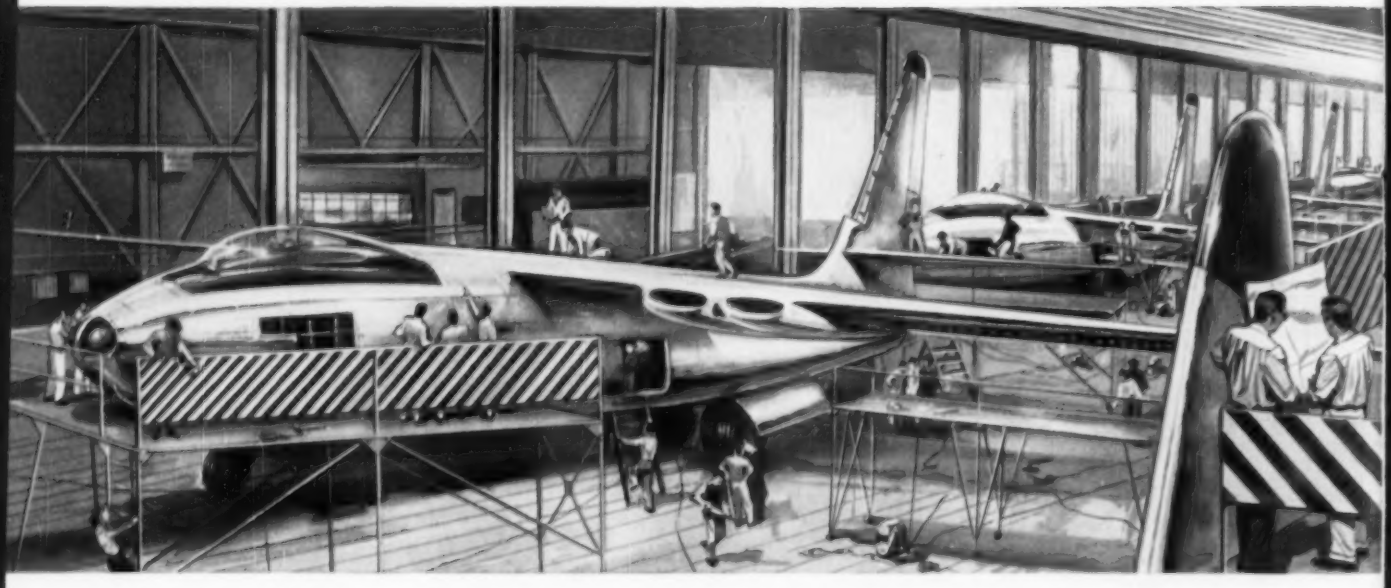
British Fire Seaslug Missile In Navy Tests

Seaslug, a British medium range surface to air missile for naval use, is fired from HMS Girdle Ness, Royal Navy's guided weapons ship. The four booster rockets are jettisoned when supersonic speed is reached and Seaslug is propelled after that by a single sustainer.

"Triple ramp" launcher, automatically fed from magazine below decks, is used to fire the weapon, in this case from the Girdle Ness forecastle. British say that ship's pitch and roll do not affect Seaslug's accuracy. Four guided missile destroyers will be fitted with the weapon.

Armstrong Whitworth was coordinating contractor for the weapon, and nine other companies participated, including Sperry Gyroscope, General Electric, Sir George Godfrey & Partners, McMichael Radio and Imperial Chemical Industries.

PACKARD ELECTRIC / *Don't save pennies here*



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Hidden flaws in insufficiently tested lengths of aircraft cable are open invitations for production trouble. You can't avoid them by watching price tags. But you can sidestep the entire problem through Packard Electric.

Packard Electric's reputation for *selling trouble-free cable* has been firmly established with all leading aircraft manufacturers, who have learned that uniform quality is their best assurance against costly cable failures.

At Packard Electric, for instance, every tenth worker is a qualified cable inspector. And, on many jobs, their work is augmented by special machines automatically testing *every single inch* of cable as it is being built.

Because it builds uniformly high quality, Packard Electric has become the world's most reliable source for Low Tension, High Tension and High Heat cable, built to greatly exceed every established standard of performance and safety.

At Packard Electric, cable prices are the only things that are competitive. Nobody exceeds our overall quality and dependability. And, in the long run, that's where you save! Make Packard Electric your Number One source of supply. Branch offices, for your convenience, are located in Detroit, Chicago and Oakland.

Packard Electric

Warren, Ohio — GM GENERAL MOTORS

"Live Wire" division of General Motors

Navy Contracts

Following is a list of unclassified contracts of $25,000 and over as released by Navy Contracting Offices:

NAVY DEPARTMENT, BUREAU OF SHIPS, Washington 25, D. C.

Radio Corp. of America, 75 Varick St., New York, N. Y. Single sideband transceiver RCA Model SSB-1, contract NObsr-71747 (Inv. No. 833-99612Q) 85 ea., $134,175.

Nuclear-Chicago Corp., 223 W. Erie St., Chicago, Ill. Neutron survey meter, contract NObsr-71724 (Inv. No. 884E-78189Q), 48 ea., $37,594.

DEPARTMENT OF THE NAVY, BUREAU OF AERONAUTICS, Washington 25, D. C.

Jered Industries, Inc., 2323 East Nine Mile Rd., Hazel Park, Mich. Design, develop, construct and furnish two aircraft crash dollies, NOas 57-529-c (SE-72-1660-57) $38,870.

Philco Corp., 22nd St. and Lehigh Ave., Phil, 32, Pa. Field engineering services for providing technical assistance and instructions in the maintenance, repair, and operation of AN/ASB-1 bomb director sets, NOas 57-336-s (AV-05-3501-57) $197,554.

The Maico Co. Inc., 21 N. Third St., Minneapolis 1, Minn. Telemetering Kits, NOas 57-551-f (GM-32-2995-57) $286,216.

Hoffman Laboratories, Inc., 3761 S. Hill St., Los Angeles 7, Calif. ARN/21 and 21A radio equipment NOas 57-290-f (PD-36-822-57) $18,633,572.

Bendix Aviation Corp. (Eclipse-Pioneer Division), Teterboro, N.J. Automatic pilot system, NOas 57-430-f (AE-72-1869-57) $44,437.

Collins Radio Co., Cedar Rapids, Iowa. AN/ARC-52 (XN-4) radio sets, NOas 56-222-d (EL-62-2658-56) $57,780.

Consolidated Electrodynamics Corp., 300 North Sierra Madre Villa, Pasadena, Cal. Portable helium leak detectors NOas 57-407-f (MA-30-3812-57) $43,720.

North American Aviation, Inc. (Columbus Div), Columbus, Ohio. Services and materials in the maintenance of Model R4Y-1 aircraft, NOas 57-734-d (MA-33-4399-57) $137,692.

AVIATION SUPPLY OFFICE, 700 Robbins Ave., Philadelphia 11, Pa.

Intercontinental Dynamics Corp., 170 Coolidge Ave., Englewood, N.J. Testers & publications (383/29067-1483/5, 6/66, 383/9504-68/57), various, $507,238.

James G. Biddle Co., 1316 Arch St., Philadelphia 7, Pa. Testers (IFB-383-1634-57) 260 ea., $37,050.

Aerosonic Instrument Corp., Hercules & Range Rd., Clearwater, Fla. Indicators (IFB-383-1487-57), 1,442 ea, $108,150.

Eclipse Pioneer Div., Bendix Aviation Corp., Teterboro, N.J. Testers and publication (IFB 383-1626-57), various, $81,937.

Airesearch Mfg. Co. of Arizona Valve controls & compr. bleed pilots (383/2118-5003/55), $35,958.

Pesco Products Div., Borg-Warner Corp., 24700 N. Miles Rd., Bedford, Ohio. Couplings, diaphragm assys. (383/2218-5007/55), various, $26,157.

General Electric Co., 3 Penn Center Plaza, Philadelphia 2, Pa., voltmeters, (383/2130-7 E 3/1/55), 220 ea., $49,510.

Aerosonic Instrument Corp., Hercules & Range Rd., Clearwater, Fla., indicators, (PREN 11-1252/57S various $41,589.

Chandler-Evans Div., Pratt & Whitney Co., Inc., Charter Oak Blvd., West Hartford, Conn., throttles, bellow assys, (383/2116-226/53), various, $122,750.

Ingersoll-Rand Co., 2037 Chestnut St., Philadelphia, Pa., valves, (383/23263-119 S 3/1/57), various, $44,766.

Scintilla Div., Bendix Aviation Corp., Sherman Ave., Sidney, N. Y., kits, magneto assys, distributors, (383/2116-5001 x 5/4/54 383/2116-221/53), various, $2,272,869.

Aircraft Radio Corp., Boonton, N. J., radio receiving sets, (MIPR-R02-790041-SC-01-23, PREN-11/777/57), various, $267,613.

Bendix Products Div., Bendix Aviation Corp., 401 Bendix Dr., South Bend 20, Ind., by pass and relief valves, (383/29023-29P 6/4/57), 188 ea., $45,128.

Scintilla Division, Bendix Aviation Corp., Sherman Ave., Sidney, N. Y., maintenance parts for harness assys, (383/2118-254/53), various, $115,313.

Houdaille Industries, Inc., 537 E. Delavan Ave., Buffalo 11, N. Y., danger assys, (383/2110-1136/53, 383/2110-1327 x 7/1/53, 383/2110-1409 x 7/1/53), various, $203,405.

Reliance Mfg. Co., 340 Fifth Ave., N. Y. 1, N. Y., parachute assys, (IFB-383-116-57), 4600 ea., $589,858.

Ingersoll-Rand Co., 2037 Chestnut St., Philadelphia, Pa., compressors, (IFB-383-1294-57), various, $488,010.

The Cornelius Co., 550 39th Ave., N. E. Minneapolis 21, Minn., compressor assys, (JD-383/2110-1913 x 7/1/53), 123 ea., $187,-493.

Gardiner Mfg. Co., 2711 Union St., Oakland 7, Calif., cable assy sets, (JD-IFB-383-401-57), 1279 ea., $197,593.

Airesearch Mfg. Co., A Div. of the Garrett Corp., 9851-9951 Sepulveda Blvd., Los Angeles 45, Calif., air-turbine starters & valve controls, (383/2118-17/54), various, $244,720.

David Clark Co., Inc., 360 Park Ave., Worcester 2, Mass., helmets & earcup & headband assys, (383/29045-35 G 2/1, 3/57), various, $884,790.

Airesearch Mfg. Co. of Arizona, A Div. of the Garrett Corp., Sky Harbor Airport, 402 S. 36th St., Phoenix, Ariz., kits, (383/2118-277 S 2/1/53), 733 ea., $117,888.

Fletcher Aviation Corp., Fletcher Airport, Rosemead, Calif., assys & maintenance parts for R3Y-1,2 aircraft, (383/2150-191/55), various, $797,004.

Airesearch Mfg. Co. of Arizona, A Div. of the Garret Corp., Sky Harbor Airport, 402 S. 36th St., Phoenix, Ariz., spare for power units, (383/2150-5060 S 2/3/55), various, $1,658,585.

The Goodyear Tire & Rubber Co., Inc., 1144 E. Market St., Akron 16, Ohio, wheel assys, (383/2110-1499/53), 383/2110-1578/53), various, $163,899.

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bor Airport, 402 S. 36th St., Phoenix, Ariz. services & materials for aircraft & ground equipment, (383/23055-1 S 2/1/57, 383/2118-276 S 2/1/57, 383/218-276 S 2/1/53), various, $373,368.

Bendix Products Div., Bendix Aviation Corp., 401 Bendix Dr., South Bend 20, Ind., maintenance parts for various aircraft, (383/2110-1391 x 1/1/53), various, $216,531.

Douglas Aircraft Co., Inc., 3000 Ocean Park Blvd., Santa Monica, Calif., parts for R6D spares, (383/2110-1701 A 4/1/53), various, $76,209.

Chance-Vought Aircraft, Inc., P. O. Box 5904, Dallas, Texas, special airframe tools for F7U-3 aircraft, (383/2110-1800 S 2/1/53), various, $168,955.

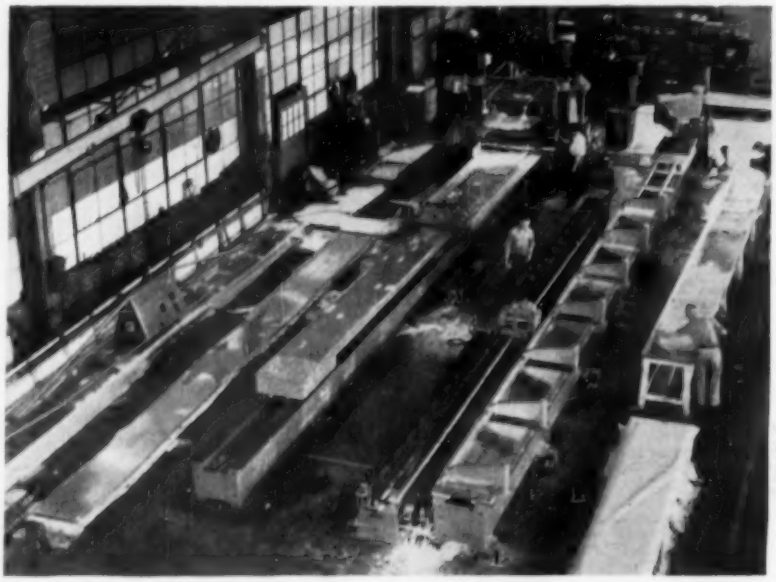
Holley Carburetor Co., 11955 E. Nine Mile Rd., Van Dyke, Mich., services, repair & modify fuel controls, (MIPR 41-608-7-03D-2305), various, $259,021.

Champion Spark Plug Co., 900 Upton Ave., Toledo, Ohio, spark plugs, (383/29081-7 x 5/2/57), various, $790,100.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., amplifiers, (383/2120-5006/55/AERO), 69 ea., $285,183.

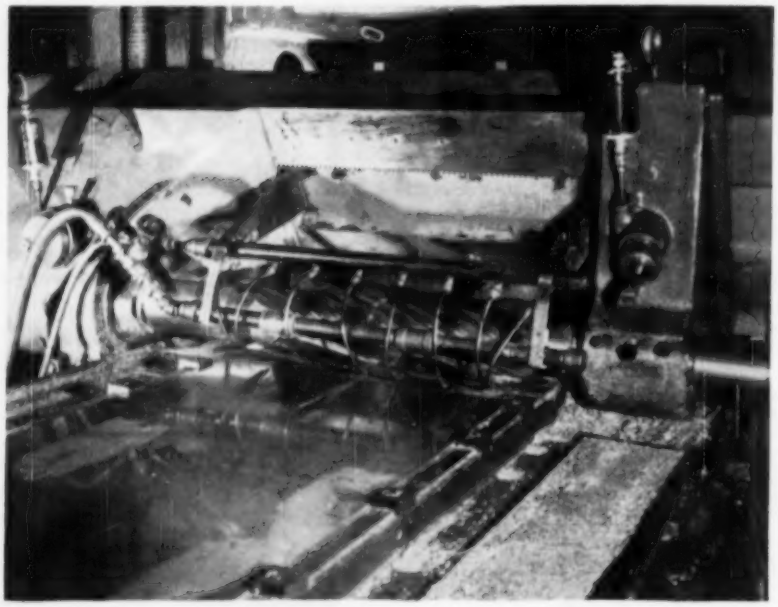
Jetronic Industries, Inc., Main & Cotton Sts., Manayunk, Philadelphia 27, Pa., test bench harnesses, (383/29069-20 E 2/6/57/AERO, 383/2110-8452/55), various, $105,-618.

The Goodyear Tire & Rubber Co., Inc., 1144 E. Market St., Akron 16, Ohio, wheel assys, (383/210-1178 x /1/53/AERO), 767 ea., $116,124.



C-130 Wing Panels Milled

Tapered lower surface wing panels for Lockheed C-130 are milled at Portland Machine Tool Works, South Portland, Me. (above). Helical cutter is held steady (below) while table holding panels is tapered. The 37 ft. x 27 in. wide skin is 0.155 in. thick in the middle with the outboard 13 ft. at each end tapered to .080 in. tip thickness. Floor-to-floor time for entire operation is 1¾ hours.



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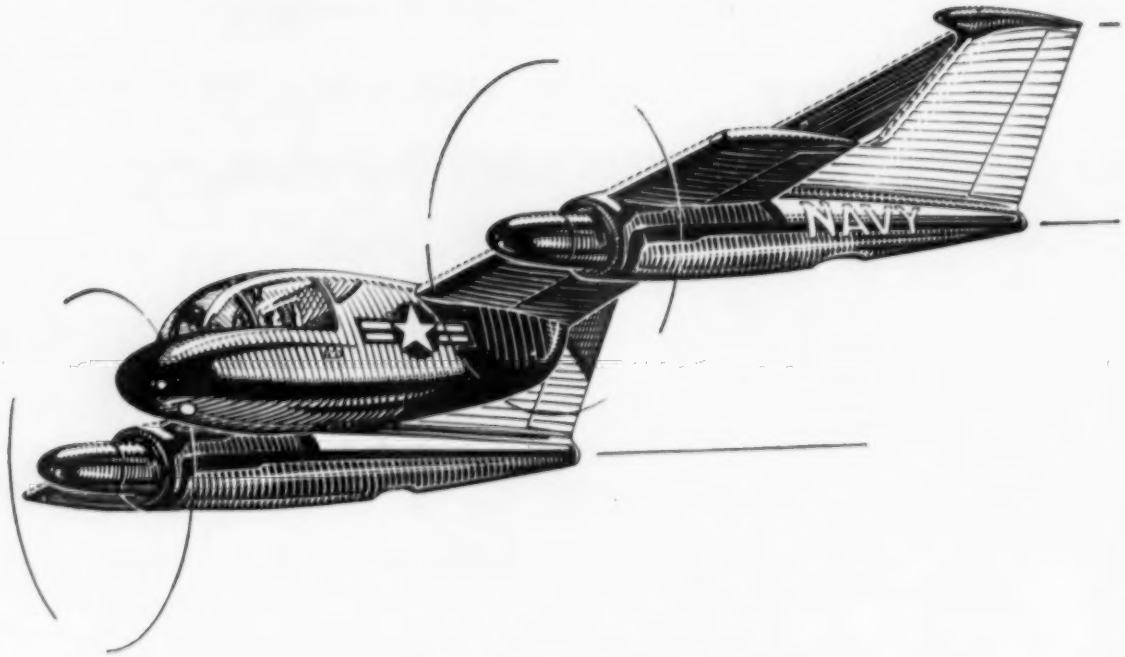

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LETTERS

"CAA Closed Airway"

An item which appeared on p. 25 of the June 17 issue of AVIATION WEEK alleged that the Navy exercised unilateral control of the airspace along the Miami, Florida-Wilmington, North Caroline airway (Control Area 1150), barring civil aircraft from traversing this route.

The statement, "First news airlines received of the Navy's action was preemptory notice directing Eastern and National flights northbound from Miami to proceed to the inland airway at Jacksonville," is not factual. Actually, restrictions placed upon civil air carriers in this case, as well as in previous cases, were imposed by the Civil Aeronautics Administration through its refusal to clear aircraft through the area in which the Navy was conducting training exercises.

The Navy maintains the position that its radar control capabilities are more than adequate to provide safe separation between civil and naval aircraft with due regard for the safety of the former as required by Article 3 of the Chicago Convention. It should be noted that many other member nations of the International Civil Aviation Organization observe the principle of "permeability of the airways" by military aircraft under military radar control. It is also pertinent to note that American flag carriers accept this principle in many parts of the world.

I trust the foregoing will clarify the facts in this case.

GARRISON NORTON
Assistant Secretary of the Navy
for Air, Washington, D. C.

Working Time 30%

Please let me add my voice to those of the Happy Jobshopper (AW May 20, p. 158) and Unhappy Homesteader (AW June 17, p. 122).

I have worked as an engineer in two large aircraft plants, and have finally come to the conclusion that my long years spent in college "sweating out the books" were completely wasted. I am one of those unfortunates who received only a bachelor's degree and, therefore, am not qualified to do anything on a higher level than multiply and divide or draw interminable graphs. It is no wonder that the turnover of engineers is so high; we are incessantly searching for some place that will utilize our abilities and knowledge, and finding nothing but disillusionment.

True, these are merely gripes stemming from dissatisfaction, but behind most gripes lies an element of truth. Several of us asked our supervisor what was really required to get ahead at our company. His reply was, "A genuine interest in the job, shown by your willingness to come in and work extra hours."

Since then we have seen by observation that this is certainly true; the men who are rapidly advancing in position and salary are those who work long after the others have gone home in the evening—in many cases, 20 to 40 extra hours a week (all without pay, of course). There are several engineers who work very hard all day, but then leave at quitting time. These are not regarded as the "top-notchers," even though in many cases the quality and quantity of their work is far superior to that of the late workers. In my opinion, this is a deplorable state of affairs. Simplified, it boils down to this:

Problem: How do I advance as an engineer in the aircraft industry?

Solution: Make sure the boss can see you are working, *especially after hours*. (On three or four occasions when our supervisor was out of town, these late workers left the same time as everyone else.)

Because of the lack of interest in graph-plotting and the uselessness of attempting to do a good thorough job in the face of the late workers, the efficiency of most engineers is unbelievably low. Another employe and myself studied the members of our group for a week, and found that on the average the engineer was actually working about 30% of the time. This includes a substantial allowance for "thinking time" (which I suspect in many cases is just relaxation time). The rest of the time is distributed as follows: bull sessions—60%; ogling girls—5%; miscellaneous (shooting rubber bands, making paper airplanes, etc.)—5%.

As the Unhappy Homesteader commented, where else but in the aircraft industry can you get paid so much for doing so little?

DISGUSTED ENGINEER

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Satellites for Defense

In reply to the letter (AW June 17, p. 122) titled "Opposes Cuts," the defense of this country does not depend on how much money the government can spend in a ridiculous fashion as it does today but in spending the money wisely as in a coordinated missile program away from windy generals, admirals, and political figures. A coordinated program of this type would have given this country manned satellites today, a defense far superior and at less cost.

This, of course, would be opposed by the Republican Party which is big business, for their main propaganda line of prosperity would be eliminated.

Knowing this Russia can sit back (while concentrating on establishing manned satellites) and watch this country spend itself silly. It is not Russia who is on the spot, but the United States. Without the war threat we do not have prosperity, with the war threat we have a fly-by-night prosperity. The latter is a good propaganda line for the politician, especially during election time.

The adults and children of this country have a marvelous future, a few extra dollars today and no tomorrow. I don't think anyone needs a dollar that desperately. I believe the American people would prefer a decent existence for their children with a superior defense and an authentic prosperity than the present ridiculous situation.

As for our excellent economic situation, the U. S. Senate is about to start an investigation into this field and I don't blame them with the dollar value about 45 cents.

In conclusion, this country needs a coordinated missile program to develop manned satellites (before Russia) for an authentic defense, and the election of intelligent personnel into the government to give this country a genuine prosperity.

EDWARD H. TRASKO
West Hartford, Conn.

Mistaken Identity

Re AVIATION WEEK, June 17, p. 33: maybe a Neptune can carry one under each wing, but I'll bet you a (stormy) Petrel that the plane depicted is a PB2Y-4. Pretty juvenile mistake for AVIATION WEEK.

J. SHELDON LEWIS, Chief Pilot
Thatcher Glass Manufacturing Co., Inc.,
Elmira, N. Y.

(Pilot Lewis and other sharpeyed readers are right. Plane depicted is a Convair PB2Y-4 Privateer.—Ed.)

More Wind Tunnels

It seems that our customers are the only ones who know of our wind tunnel facilities. Your listings of small supersonic and transonic wind tunnels on p. 341 and 345, respectively, of the June 3 issue are incomplete. In our aerodynamic laboratories we currently operate three small supersonic wind tunnels, one of which is 8x8 in., another 12x12 in., and the third 14x14 in. in test section. These tunnels all cover the Mach number range from 1.5 to 4.0. They are all push-pull type blowdown facilities. Stagnation pressures ranging from 1 to 10 atmospheres are possible. At these same laboratories we also operate a 22x22 in. transonic tunnel. This tunnel has a stagnation pressure of one atmosphere and is of the blowdown type.

In addition to these wind tunnel facilities we also have specialized engine exhaust nozzle test rigs. In these rigs we can cover nozzle pressure ratios to 40 to 1 with both primary and secondary internal flows and we are also able to study engine exhaust nozzles operating with both internal and external flow.

Actually it is always a surprise to me that you are able to collect such a vast amount of information as you incorporate into your research and development editions. This issue remains on my desk throughout the year and is a continually useful source of reference for me.

J. LEONARD FRAME, President
FluiDyne Engineering Corp.
Minneapolis, Minn.

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